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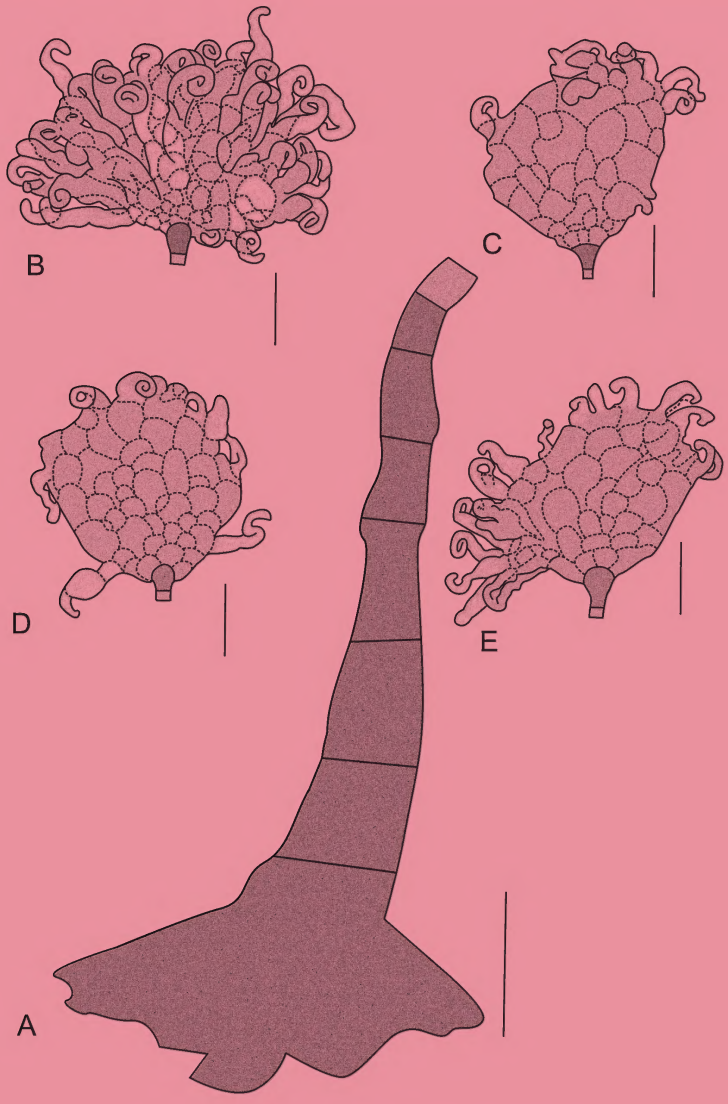

Pseudoacrodictys magnicornuata sp. nov.
(Fiuza & al.— FIG. 2, p. 35)
FIUZA & CRUZ, *artists*

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Volume 124

p.257, line 6	for: MB 563347	read: MB 802332

Volume 126

p.63, line 8	for: The holotype collection and one additional collection read: the collections

Reviewers — volume one hundred twenty-seven

The Editors express their appreciation to the following individuals who have, prior to acceptance for publication, reviewed one or more of the papers prepared for this volume.

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From the Editor-in-Chief

Mycotaxon 127 contains 32 papers by 111 authors (representing 19 countries) and revised by 39 expert reviewers.

Within its pages are three new genera from Brazil (*Anabahusakala, Atrogeniculata, Helicodochium*) and 36 other taxa new to science representing *X* from *Acrodictys, Ceratosporium, Helminthosporium, Mensularia, Pertusaria, Pleurophragmium, Pseudoacrodictys Pseudospiropes, Repetophragma, Septobasidium,* and *Solicorynespora* from China; *Codinaea* from Costa Rica; *Corymbiglomus* from Chile; *Corynesporopsis* from Spain; *Cristinia, Distocercospora,* and *Radulodon* from India; *Diplococcium, Henicospora, Isthmophragmospora, Lembosia, Nigrolentilocus,* and *Sporidesmiella* from Brazil; *Paliphora* from Malaysia; *Phallus* from Vietnam; and *Puccinia* from Greece.

In addition to range extensions and/or new hosts for previously named taxa, we also offer new combinations in *Codinaea* and *Pholiota,* newly established synonymies and typifications, overviews of *Moreaua* (in Japan and Korea) and *Ramularia* in Poland and valuable conclusions from Z. Schaefer *Lactarius* type and BRNM collection studies.

With our usual warm regards and wishes for a productive year,

Lorelei L. Norvell (*Editor-in-Chief*)
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A new species of *Helminthosporium* from Jiangsu, China

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Abstract— *Helminthosporium nanjingense* sp. nov. is described from Jiangsu Province, China, on dead branches of an unidentified tree. The new fungus produces a conspicuous yellow-green pigment on PDA media. Its microscopic features and ITS sequence are provided.

Key words — systematics, saprobes, hyphomycetes

Introduction

During the recent survey of *Helminthosporium* species in China, the authors discovered eleven new species and seven new records (Zhang & Zhang 2009, Zhang et al. 2003, 2004, 2007, 2010). In this paper we propose a new species of *Helminthosporium* from Jiangsu Province, China.

Materials & methods

Unidentified dead branches with *Helminthosporium* species were carefully inspected under a Nikon SMZ1500 stereomicroscope. Tissues mounted in a drop of lactophenol were examined microscopically. Conidia and conidiophores were photographed using a Nikon Eclipse 80i microscope with Nikon DS-U2 camera, and microscopic measurements were completed by using NIS-Elements Image Analysis Software.

DNA was obtained from mycelia scraped from single spore cultures of the strains on a PDA plate and extracted using the Cell Genomic DNA Isolation Kit (LifeFeng, Shanghai, China) following the manufacturer's instructions. A final volume of 25 μL [comprising 1 μL ITS1 forward sequencing primer (5μM) and 1 μL ITS4 reverse sequencing primer (5 μM), 9.5 μL ddH_2O, 12.5 μL 2× Taq PCR Master Mix (including 0.1 U/μL Taq DNA Polymerase, 0.4 mM each dNTPs, 2× Taq Buffer, red and blue indicator dye, PCR enhance reagent and proteide steady reagent), 1 μL fungal DNA] was amplified using a Eppendorf PCR thermal cycler device (Germany) as follows: 95°C initial denaturation (2 min), 33cycles of 95°C (30 s), 55°C (30 s), 72°C (2 min), and a final step of 72°C (7 min). The 5-μL PCR products were analyzed through electrophoresis on a 1.0% agarose gel with 1× Tris-acetate-EDTA (TAE electrophoresis buffer). The PCR products were sequenced by Shanghai Sangon Biological Engineering Technology & Service Co. Ltd.,

China (Xie et al. 2010; Schoch et al. 2012). The type specimen is deposited in HSAUP (Herbarium of Shandong Agricultural University: Plant Pathology), and the ex-type culture in HHAUF (Herbarium of Henan Agricultural University: Fungi).

Taxonomy

Helminthosporium nanjingense Meng Zhang, Xiao J. Wang & H.Y. Wu, **sp. nov.**

Fig. 1

MycoBank MB 804655

Differs from other similar species of *Helminthosporium* by its smooth-walled, longer, slightly thinner conidia and its longer conidiophores.

Type: China, Jiangsu Province, Nanjing, on dead branches of an unidentified tree, 8 Sep. 2002, coll. M. Zhang (**Holotype**, $HSAUP_{02}0198$; ex-type culture, $HHAUF_{02}0380$=$ZM_{02}0380$; GenBank KF192322).

Etymology: Latin, *nanjingense,* for the collection locality.

Colony on the natural substrate effuse, black, hairy. Mycelium mostly immersed in the substratum. Colony on PDA media effuse with yellow-green pigment. Conidiophores arising solitary or in fascicles from the cells of the mycelium, simple, straight or flexuous, thick-walled, sub-cylindrical, smooth, brown to dark brown, 250–470 µm long, 6.9–7.7 µm wide, with well-defined small pores at the apex and laterally beneath the upper 1–4 septa; 8.6–11 µm wide at the base cell which sometimes inflated up to 15.5 µm. Conidia subulate or nearly whip-like, straight or curved, thin-walled, smooth, pale brown, 6–17 distoseptate, 64.5–170.5 µm long, 7.3–10.3 µm wide in the widest part, narrowing towards the apex to 5.0–6.8 µm wide, with a blackish-brown scar at the base, 1.4–2.7 µm thick.

Comments: *Helminthosporium nanjingense* is most closely related to *H. conidiophorellum* Meng Zhang & T.Y. Zhang and *H. subhyalinum* Meng Zhang & T.Y. Zhang in conidial morphology (subulate or nearly whip-like shape). *Helminthosporium conidiophorellum* differs from *H. nanjingense* by its shorter and slightly wider conidia (100–147.5 × 9.5–11 µm) that are sometimes slightly verruculose and its shorter wider conidiophores (60–280 × 7.0–8.5 µm) (Zhang & Zhang 2009). *Helminthosporium subhyalinum* is differentiated by its nearly colorless, shorter, slightly wider conidia (72–125 × 9.5–11.5 µm) and shorter conidiophores (120–200 µm); the thick black conidial apex wall of *H. subhyalinum* is also a striking distinguishing characteristic (Zhang et al. 2007).

The amplified rDNA (ITS) region derived from the holotype was 454 bp (GenBank KF192322). The BLAST comparison with previously published *H. solani* and *H. velutinum* sequences shows only 89% nucleotide homologies for both. Reference sequences for comparative analysis were obtained from

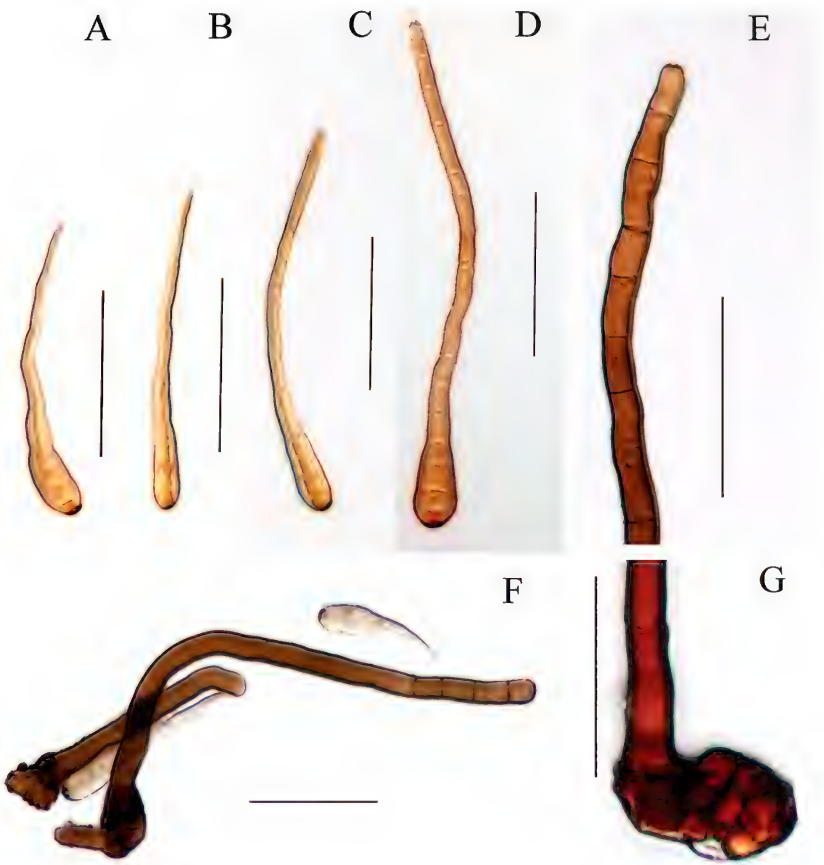

Fig. 1 *Helminthosporium nanjingense* (holotype HSAUP $_{02}$01980): A–D. Conidia; E. Conidiophore apex; F. Conidiophores; G. Conidiophore base. Scale bars = 50 μm.

GenBank database by the BLAST search program (http://www.ncbi.nlm.nih.gov/BLAST/).

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Helicodochium, a new microfungus from submerged wood in Brazil

Josiane Santana Monteiro[1], Luís Fernando Pascholati Gusmão[2]*, & Rafael F. Castañeda-Ruiz[3]

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Abstract — An interesting helicosporic fungus collected on submerged wood in the Brazilian Amazon, 'Área de Proteção Ambiental Ilha do Combu', Brazil, is described and illustrated. *Helicodochium amazonicum* gen. & sp. nov. is characterized by sporodochial conidiomata, macronematous branched very pale brown to subhyaline conidiophores, and conidiogenous cells that produce helicoid multiseptate smooth hyaline conidia.

Key words — asexual fungi, taxonomy, freshwater

Introduction

Saprobic hyphomycetes are highly diverse on plant material, and many new genera or species have recently been discovered (e.g. Castañeda-Ruíz et al. 2009, 2012, Zhang et al. 2009, 2011, Ma et al. 2011, Cruz et al. 2012, Ren et al. 2012). Taking into account its great geographical and environmental variety, the Brazilian Amazon is considered an important reservoir of biodiversity. However, its mycobiota, especially microfungi, is poorly known. During a mycological survey of fungi associated with submerged litter at Brazilian Amazon forest, an interesting fungus was collected from submerged wood. The specimen, which differed remarkably from previously described asexual genera, is described here in a new genus.

Samples of submerged litter were placed in paper and plastic bags, taken to the laboratory, and prepared according to Castañeda-Ruiz (2005). Mounts were prepared in PVL (polyvinyl alcohol, lactic acid, phenol) and measurements

were made at ×1000. Micrographs were obtained with an Olympus microscope (model BX51) equipped with bright field and Nomarski interference optics. The type specimen is deposited in the Herbarium of Universidade Estadual de Feira de Santana (HUEFS).

Taxonomy

Helicodochium J.S. Monteiro, R.F. Castañeda, A.C. Cruz & Gusmão, **gen. nov.**

MycoBank MB804995

Differs from *Vanbeverwijkia* by monoblastic conidiogenous cells and from *Everhartia* by differentiated dry conidiomata, macronematous conidiophores, and pseudoparenchymatous stromata.

Type Species: *Helicodochium amazonicum* J.S. Monteiro et al.

Etymology: *Helico-*, referring to the helicoid conidia + *-dochium*, referring to sporodochial conidiomata.

Asexual fungus. Colonies on the natural substrate effuse, pale pinkish. Mycelium mostly immersed. Conidiomata sporodochial, apothecium-like, dry, scattered, pinkish to white, consisting of numerous conidiophores arising from a stroma of globose, thick-walled, pale brown cells with an umbilicate centre. Conidiophores macronematous, erect, branched, septate, pale brown, arising from a thick-walled, pale brown, pseudoparenchymatous stromata with globose texture. Conidiogenous cells monoblastic, integrated, determinate, terminal, pale brown to hyaline. Conidial secession schizolytic. Conidia solitary, coiled, planate, pluri-septate, hyaline.

Helicodochium amazonicum J.S. Monteiro, R.F. Castañeda, A.C. Cruz & Gusmão, **sp. nov.** Plate 1

MycoBank MB804996

Differs from *Vanbeverwijkia spirospora* by monoblastic conidiogenous cells and from *Everhartia* spp. by differentiated apothecium–like to infundibuliform dry conidiomata and macronematous conidiophores that arise from a pseudoparenchymatous stromata.

Type: Brazil, Pará, Belém, Área de Proteção Ambiental Ilha do Combu, 1°25′S 48°27′W, on submerged wood, 18.Oct.2012, coll. J.S. Monteiro (**Holotype:** HUEFS 194251; **Isotype:** HUEFS 194252).

Etymology: Latin, *amazonicum*, referring to the locality of the type specimen.

Colonies on the natural substrate, effuse, pale pinkish. Mycelium mostly immersed. Hyphae septate, 2–4 µm diam, branched, forming a pseudoparenchymatous stroma with thick-walled, smooth, pale brown, 5–10 µm diam cells in a textura globosa. Conidiomata sporodochial, apothecium-like, incurved at the centre, superficial, scattered or in groups, pale pink or white, glistening, dry, 63–100 µm long and 128–150 µm wide. Conidiophores macronematous, erect, more or less dichotomous branched below, arising

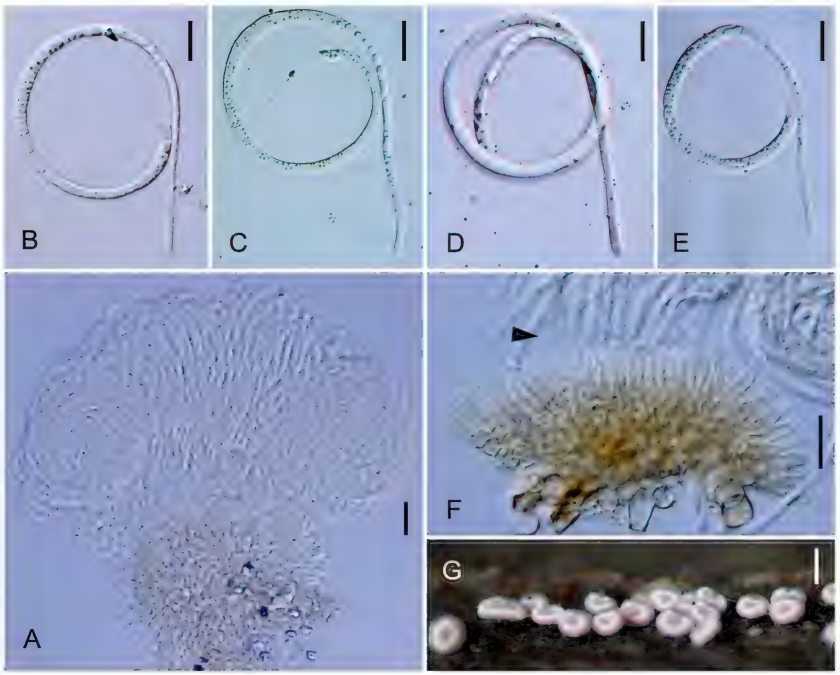

Plate. 1. *Helicodochium amazonicum* (holotype HUEFS 194251). A. Sporodochium. B–E. Conidia. F. Conidia attached to the conidiogenous cells (arrow). G. Sporodochia on the substratum. Scale bars: A–F = 20 µm, G = 100 µm.

from subglobose stromatic cells, 6–10 × 5–7 µm; 1–4-septate, 13–20 × 3–5 µm, smooth, pale brown at the base, hyaline towards the apex. Conidiogenous cells monoblastic, cylindrical. integrated, determinate, terminal, rounded to sub-truncated at the apex, 6–10 × 3–4 µm, pale brown. Conidial secession schizolytic. Conidia acrogenous, solitary, 20–33-septate, helicoid, 1½–2 times coiled, 70–82.5 µm diam, planate, slightly attenuate and subtruncate at the base, 112.5–145 × 4–6 µm, 3–4 µm wide at the base; rounded at the apex, 3–4 µm wide, smooth, hyaline forming a compact, incurved cluster towards the centre of the conidiomata.

Note: Seifert et al. (2011) described seven helicosporous genera with sporodochial conidiomata. Among these hyphomycetous fungi, only *Everhartia* Sacc. & Ellis (Yanna et al. 2000) and *Vanbeverwijkia* Agnihothr. (Agnihothrudu 1961) share morphologically comparable sporodochia, conidiogenous cells, and conidia with *Helicodochium*. However *Everhartia* has gelatinous sporodochia with micronematous, unbranched (or poorly branched) conidiophores, lacking

pseudoparenchymatous stromata and conidia composed of long chains of cuboid to globose cells. The monotypic genus *Vanbeverwijkia* is characterized by phialidic conidiogenous cells (Goos 1987, Shearer & Crane 1971), although thallic disarticulation was described by Agnihothrudu (1961). Neither developmental pattern is observed in *Helicodochium* conidia.

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Anabahusakala, a new genus from the Brazilian Amazon rainforest

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Abstract — *Anabahusakala amapensis* gen. & sp. nov. is described and illustrated. This fungus is distinguished by differentiated robust dark brown conidiophores that are pale brown to brown and branch irregularly towards the apex. The conidia, which are thallic-arthric, cylindrical, sub-oblong, Y-shaped to irregular, and pale brown to brown, occur in branched chains formed by disarticulation of the conidiophore branches.

Key words — asexual fungi, systematic, palm tree

Introduction

Several microfungi were collected during a survey of saprophytic conidial fungi on dead palm leaves in Brazil's Amapá National Forest Reserve. Among these samples an interesting arthric-thallic fungus was discovered that represents a new genus and species, which are described and illustrated herein.

The samples were examined in the laboratory using a stereomicroscope and mounted in lacto-glycerol for study under a light microscope. Specimens are

deposited in the Instituto de Pesquisas Científicas e Tecnológicas do Estado do Amapá (HAMAB).

Taxonomy

Anabahusakala L.T. Carmo, J.S. Monteiro, R.F. Castañeda & Gusmão, **gen. nov.**

MycoBank MB805030

Differs from *Bahusakala* by its macronematous, robust, fasciate conidiophores irregularly branched at the apex and its cylindrical to irregular, septate, pigmented conidia formed by disarticulation of the branches.

Type Species: *Anabahusakala amapensis* L.T. Carmo et al.

Etymology: Greek, *Ana-*, meaning upwards, back, again; *-bahusakala*, referring to the hyphomycete genus *Bahusakala*.

Asexual fungi. Conidiophores macronematous, mononematous, branched, septate, pigmented. Conidiogenous hyphae holothallic, pigmented; conidial secession schizolytic. Conidia catenulate, septate, pigmented, formed by disarticulation of the conidiogenous hyphae.

Anabahusakala amapensis L.T. Carmo, J.S. Monteiro, Gusmão & R.F. Castañeda, **sp. nov.** Plate 1, 2

MycoBank MB805045

Differs from *Bahusakala* species by its macronematous, robust, fasciate conidiophores with irregular apical branches and its cylindrical to irregular, septate, pigmented conidia, formed by disarticulation of the branches.

Type: Brazil, Amapá State, Amapá National Forest Reserve, Parcel "Leste Oeste" 1; 0°57 N 51°36 W, on decaying leaves of *Syagrus* sp. (*Arecaceae*), 11.VII.2009, coll. J.S. Monteiro & H. Sotão (**Holotype**: HAMAB 18706).

Etymology: *amapensis,* referring to the type location, Amapá State.

Colonies on the natural substrate effuse, epiphyllous, hairy, pale brown to brown. Mycelium mostly superficial, composed of branched, septate, smooth hyphae, pale brown, 1–2 µm diam. Conidiophores macronematous, mononematous, robust, erect, straight, branched towards the apex, 3–9-septate, brown, reddish brown to black, but pale brown fasciate near the septa, smooth, 25–215 × 4–5 µm. Conidiogenous hyphae holothallic, integrated or discrete, determinate, brown to pale brown. Conidial secession schizolytic. Conidia cylindrical, Y-shaped, sub-oblong, truncated at the ends, sometimes rounded at the apex, catenulate, 1–2-septate, 7–12 × 2 µm, pale brown to brown, dry, smooth, forming by disarticulation of the apical and lateral branches of the conidiogenous hyphae.

Additional specimen examined: **BRAZIL, Amapá**, Amapá National Forest Reserve, Parcel "Leste Oeste" 1; 0°58 N 51°37 W, on decaying leaves of *Astrocaryum gynacanthum* Mart. (*Arecaceae*), 20.II.2008, coll. J.S. Monteiro (HAMAB 18709).

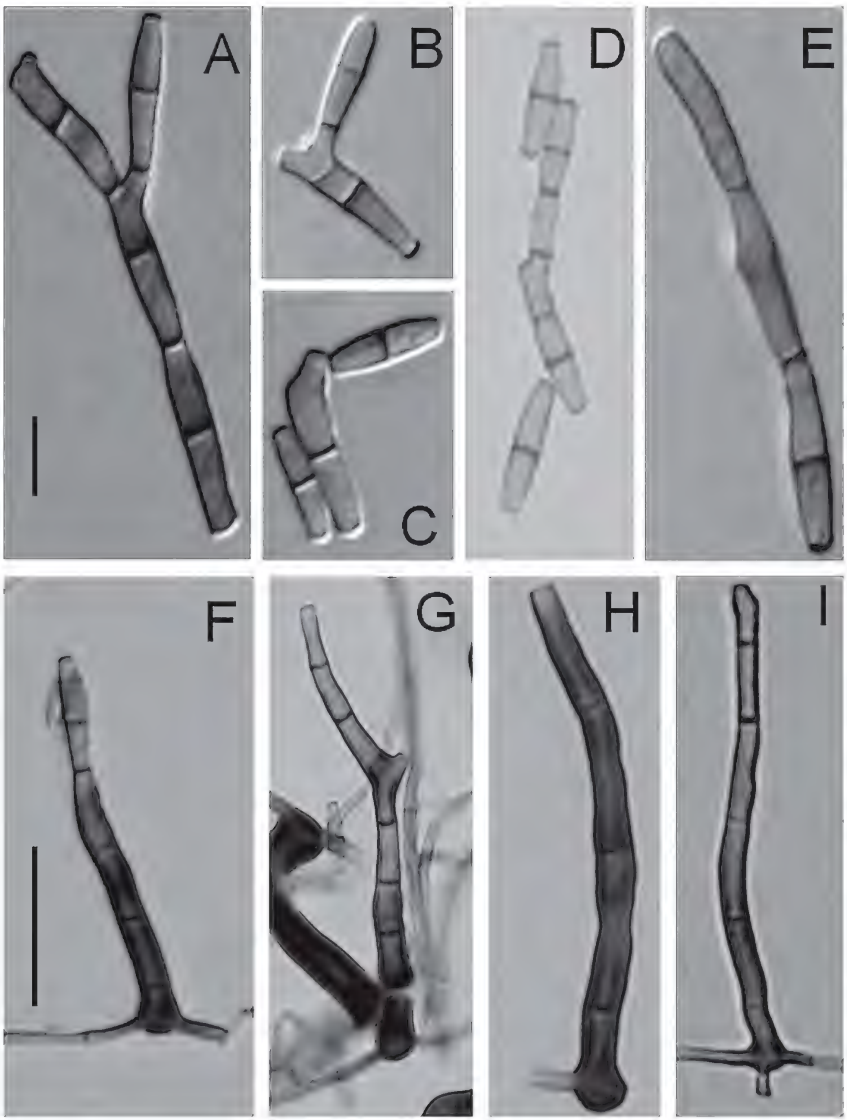

Fig. 1. *Anabahusakala amapensis* (ex HAMAB 18709). A–E. Conidia and ramoconidia. F–I. Conidiophores after disarticulation. Scale bars: A–E = 5 µm; F–I = 10 µm.

Note: *Bahusakala* (Castañeda-Ruiz et al. 1996, Ellis 1971, Guarro et al. 1980, Subramanian 1958), typified by *B. olivaceonigra* (Berk. & Broome) Subram., produces micronematous to semi-macronematous, decumbent or prostrate

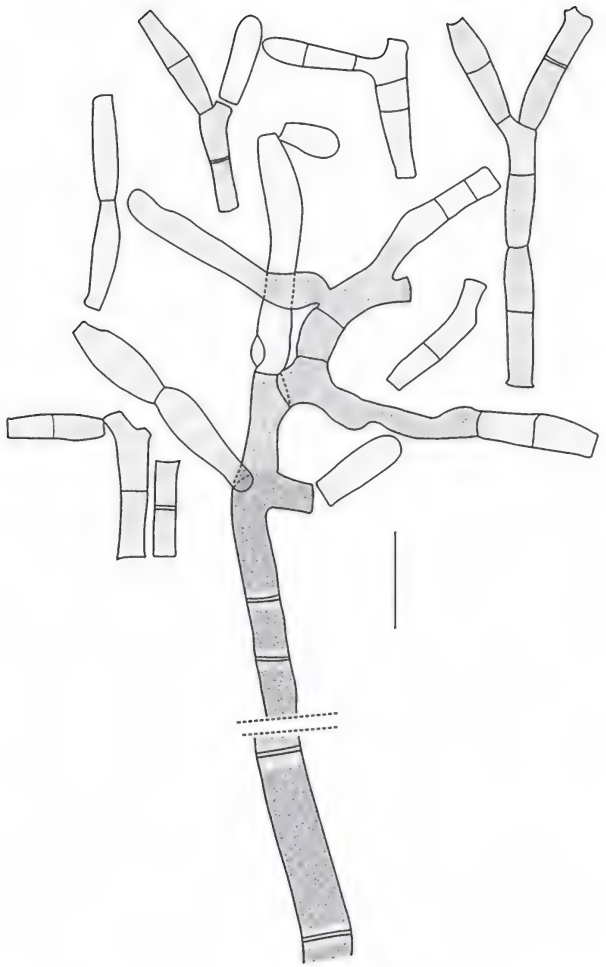

Fig. 2. *Anabahusakala amapensis* (ex HAMAB 18709).
Conidiophore, ramoconidia, and conidia. Scale bar = 10 µm.

conidiophores that form pulverous or pulvinate colonies. The *Bahusakala* thallic-conidia form when the fertile hyphae and main conidiophore axes disarticulate randomly, while in *Anabahusakala* only the apical branches, and not the main conidiophore axes, disarticulate. Of the other genera illustrated by Seifert et al. (2011) that restrict thallic-arthric conidial development to the apical branches, only *Oidiodendron* Robak superficially resembles *Anabahusakala,* and it is distinguished by the production of unicellular, rhexolytic seceding conidia that form branched chains with connectives.

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A new species of *Phaeoisaria* from intertidal marine sediment collected in Weihai, China

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Abstract — A culture of a synnematous hyphomycete belonging to *Phaeoisaria* was isolated from surface sediment on the coast of Weihai, China. It is described as a new species, *Phaeoisaria sedimenticola*, based on morphological characters and nuclear ribosomal DNA sequences (large subunit and internal transcribed spacer regions). *Phaeoisaria sedimenticola* is distinguished by its indeterminate synnemata, more or less cylindrical conidiogenous cells, hyaline obovoid to ellipsoidal conidia with pointed bases, aseptate conidia (3.6–7.5 × 2.5–4.4 μm), and 1-septate conidia (4.5–9 × 2–4.5 μm) that are slightly constricted at the septum.

Key words — ITS phylogeny, marine fungi, taxonomy

Introduction

During an ongoing investigation of fungi isolated from marine macroalgae and intertidal sediment in China, several new species and new records for China were encountered. An interesting synnematous hyphomycete, isolated on the coast of Weihai, China, and showing morphological features typical of *Phaeoisaria* Höhn. (Höhnel 1909), could not be assigned to any previously published *Phaeoisaria* species. *Phaeoisaria sedimenticola* is described here based on its morphological characters and phylogenetic analyses of ITS and LSU rDNA sequences.

The hyphomycete genus *Phaeoisaria* is easily recognized by having erect brown (or nearly so) indeterminate synnemata (one species lacks conidiomata) bearing numerous sympodially extending denticulate conidiogenous cells and single dry 0–1-septate conidia (Höhnel 1909; de Hoog & Papendorf 1976). In nature, the genus occurs mainly on leaves, bark, and twigs of plants. Fourteen species currently are accepted in the genus (Mel'nik 2012; Seifert et al. 2011).

Materials & methods

Sampling and Isolation

The uppermost 2–10 cm of marine sediment layers were sampled from the intertidal zone at Weihai, Shandong Province, China. Sediment samples were collected using sterile hollow glass tubes, which were sealed and stored in a freezer at –20 °C until processed. A soil-dilution plate method was adopted for the isolation of fungi. The isolation medium potato dextrose agar (PDA, 200 g of potatoes steamed for 45 min in 200 ml of distilled seawater and then homogenized, 20 g of agar, 20 g of dextrose, and distilled seawater to make a final volume of 1 L) was supplemented with streptomycin and penicillin G at 1g/L to inhibit bacterial growth. Colonies were incubated on PDA at room temperature (22–25 °C) with alternating 12 h/12 h fluorescent light/darkness. Specimens were deposited in the Herbarium of Ocean University of China Marine Biology, Qingdao, China (OUCMB), and cultures in China General Microbiological Culture Collection Center, Beijing, China (CGMCC).

Morphological characterization

Morphological characters were not observed on natural substrates but developed only in pure culture. Microscopic characters and measurements were observed on slides prepared with lactic acid glycerin or stained with Cotton Blue. Detailed incubation and observation methods are presented by Cheng et al. (2011). Means ± standard deviation (s.d.) based on more than 50 measurements are given for conidial dimensions.

DNA extraction, PCR amplification and sequencing

Isolates were grown in 1.5 mL microcentrifuge tubes containing 1.0 mL potato dextrose broth. The broth was decanted, and the mycelium was washed and centrifuged twice in sterile deionized water (Fernández et al. 1999). Genomic DNA was extracted according to Zhang et al. (2010). The primers ITS1 and ITS4 were used to amplify ITS rDNA (White et al. 1990), LR0R and LR7 for LSU rDNA (Fernández et al. 1999).

PCR was performed in a mixture with 12.5 µL of 2 × Taq PCR Master Mix (Tiangen Biotech, Beijing, China), 1 µL each of 10 µM primers, 1 µL of the undiluted DNA extract, with the total volume adjusted to 25 µL with distilled deionized water. PCR was performed using the following thermocycling parameters: initial denaturation at 94 °C for 2 min, followed by 35 cycles of denaturation at 94 °C for 1 min, annealing at 55 °C for 1.5 min, and extension at 72 °C for 2.5 min. A final extension step of 10 min at 72 °C was added. The PCR products were checked on 1% agarose electrophoresis gel stained with ethidium bromide. Sequencing was conducted on an ABI 3730XL automated DNA Analyzer at Sangon Biotech (Shanghai) Co., Ltd.

Sequence alignment and phylogenetic analyses

The SeqMan program was used to obtain consensus sequences. BLAST searches were performed to compare the sequences with those deposited in GenBank. Sequences with significant matches were used for phylogenetic analyses. Representative sequences of morphologically similar genera were also included. GenBank accession numbers of involved sequences are included on Fig. 1. The sequences were aligned using MAFFT version 7 online (http://mafft.cbrc.jp/alignment/software/), applying the Lins-i manual strategy with default parameters, followed by manual adjustments as necessary. The final

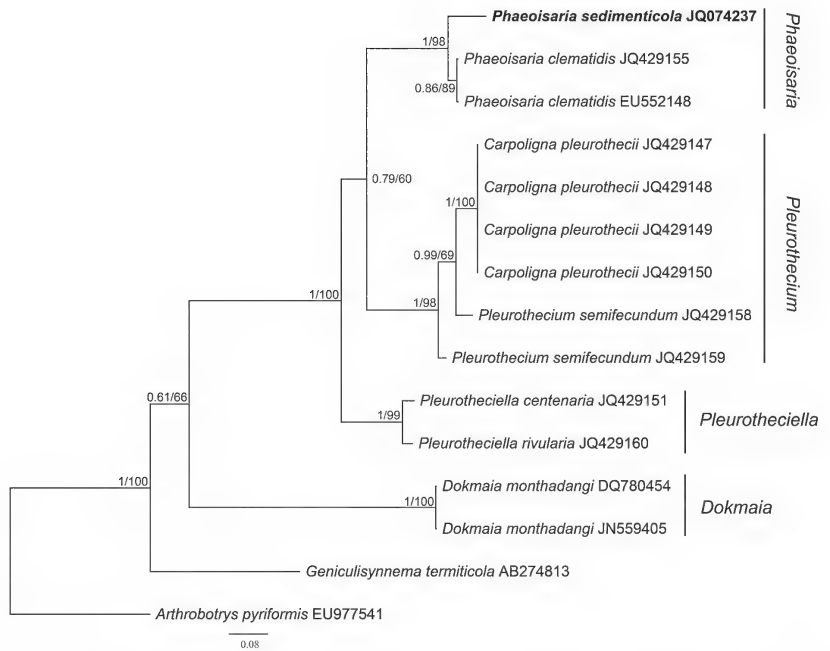

FIG. 1 Phylogenetic tree generated from Bayesian inference based on ITS rDNA sequence data set. Bayesian posterior probability and Maximum likelihood bootstrap are indicated at the nodes.

alignment of the data set was deposited at TreeBASE (submission ID 13811). Phylogenetic relationships were estimated using maximum likelihood (ML) and Bayesian inference (BI) analyses. The best-fit substitution model under the Akaike Information Criterion (AIC) (Posada & Buckley 2004) was determined by using MrModeltest 2.3 (Nylander 2004) and PAUP* 4.0b 10 (Swofford 2003).

ML analysis was performed with PAUP* 4.0b 10 (Swofford 2003). Nodal support was determined by non-parametric bootstrapping with 1000 replicates. The branch-swapping algorithm employed was tree bisection-reconnection (TBR), with MulTrees option in effect and steepest descent option not selected. A bootstrap proportion (BP) above 70% was considered a significant value. BI analysis was conducted in a likelihood framework as implemented by MrBayes 3.2.1 based on Markov chain Monte Carlo approach (Ronquist et al. 2012). One cold and three heated Markov chains were used. The BI analysis was run for 1 000 000 generations, with tree sampled every 100 generations. The first 2500 trees, which represented the burn-in phase of the analysis, were discarded, and the remaining trees were used for calculating the posterior probabilities (PP) in the consensus tree. From those trees that were sampled after the process had reached convergence, a 50% majority-rule consensus tree was computed to get estimates for clade reliability. A probability of 0.95 was considered significant.

Results

Molecular phylogenetics

Based on a megablast search of NCBI's GenBank of nucleotide database, the closest match to our LSU sequence (JQ031561) is *P. clematidis* (strain DAOM 226789, accession no. JQ429231) with 98% identity. The closest hits using the ITS sequence (JQ074237) are with *P. clematidis* (CBS 113340, EU552148) and *P. clematidis* (DAOM 226789, JQ429155) with 90% and 91% identity, respectively, followed by *Pleurotheciella* and *Carpoligna* (anamorph *Pleurothecium*).

The topologies of ITS and LSU rDNA trees were consistent with each other at the species level. Only the phylogenetic tree generated from ITS rDNA (Fig. 1) is shown here. The ITS rDNA data set consisted of 15 aligned sequences (including the outgroup sequence of *Arthrobotrys pyriformis* EU977541) and 558 characters (258 parsimony informative). The best-fitting evolutionary model for the data set was SYM + G model under the AIC. In the ITS phylogeny, our new fungus clusters with *P. clematidis* (JQ429155 and EU552148), the type species of *Phaeoisaria*, with strong support values (BI PP = 1, ML BP =98%). The *Phaeoisaria* lineage appears to be sister to the *Pleurothecium*-group, but did not receive strong branch support in either Bayesian or bootstrap analyses (BI PP = 0.79, ML BP = 60%). *Dokmaia* Promp. and *Geniculisynnema* Okane & Nakagiri occur in two separate clades distinct from the *Phaeoisaria* lineage.

Taxonomy

Phaeoisaria sedimenticola X.L. Cheng & Wei Li ter, **sp. nov.** Fig. 2

MycoBank MB 563661

Differs from *Phaeoisaria uniseptata* by its obovoid to ellipsoidal conidia and from *P. clematidis* by its shorter, sometimes 1-septate, conidia.

Type: China. Shandong province, Weihai, intertidal zone, surface marine sediment, 37°27′57.0″N 122°8′21.3″E, 5 Jun 2010, K.M. Sun (**holotype**, OUCMBIII$_{10}$1039; ex-type culture, CGMCC 3.14949).

Etymology: *sedimenticola*, indicating a lifestyle in sediment, from which the fungus was originally isolated.

Colonies on PDA attaining 30 mm diam in 14 d at 25 °C, at first smooth, buff to brown, later often with numerous synnemata; reverse greyish brown at center, olivaceous near margin; exudate and odour absent. Hyphae smooth, hyaline to pale brown, 2–2.5 µm wide. Synnemata erect, cylindrical to subulate, up to 4000 µm high or sometimes longer, 70–90 µm wide at the base, consisting of very regular, parallel, brown hyphae. Conidiogenous cells arising from synnemata with apical fertile portion bent outwards, and also arising from undifferentiated hyphae at approximately right angle. Conidiogenous cells smooth, slightly thick-walled, pale brown near base, subhyaline towards apex, more or less cylindrical, usually about 15–25 µm long, 2–3 µm wide, with conspicuous,

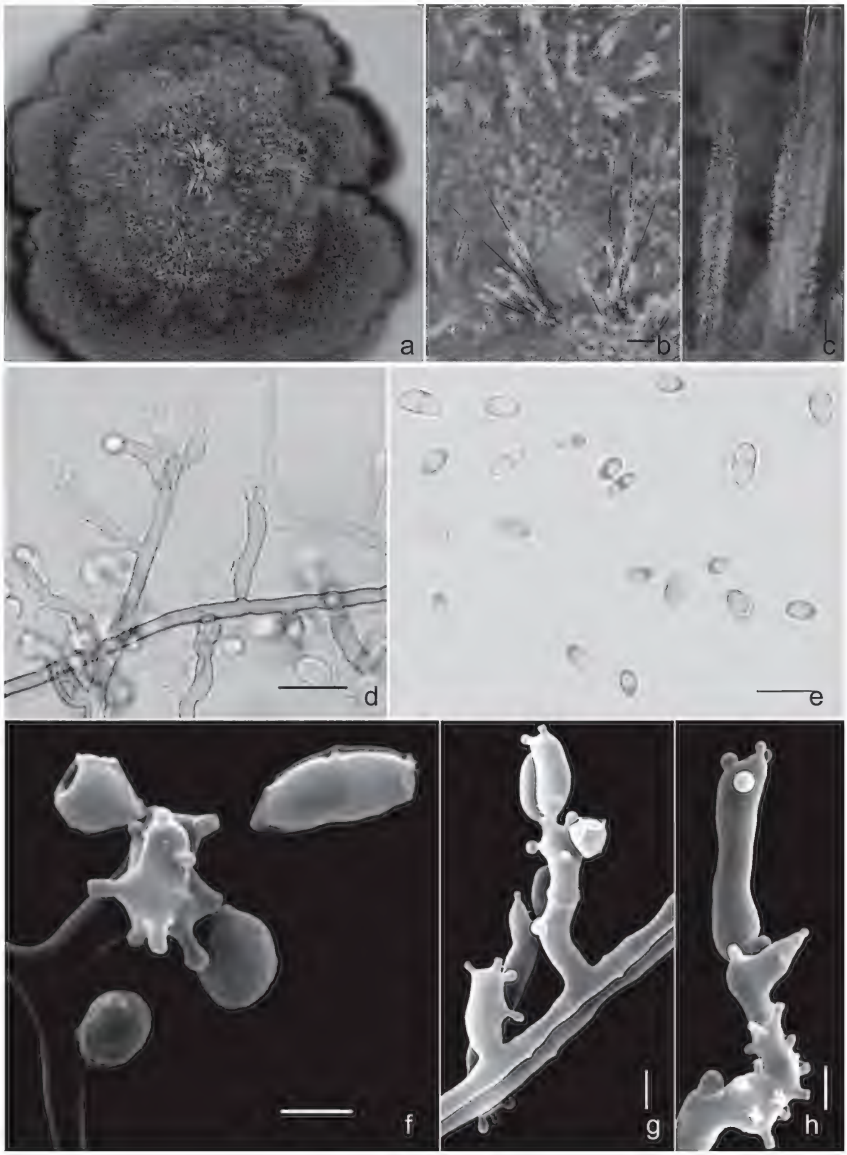

Fig. 2 *Phaeoisaria sedimenticola* (holotype, OUCMBIII$_{10}$1039). a. Colony on PDA; b–c. Synnemata; d, f–h. Conidiogenous cells with denticles; e. 0–1-septate conidia. Scale bars: b, c = 100 μm; d, e = 10 μm; f–h = 2 μm.

cylindrical denticles 0.5–1 µm long, occurring scattered or clustered in the apical region. Conidia smooth-walled, hyaline, with a pointed base, usually aseptate when attached to the conidiogenous cells, 0–1-septate after release; aseptate conidia, obovoid to ellipsoidal, (3.5–)4.5–5.5(–7.5) × (2.5–)3–4(–4.5) µm (mean ± s.d. = 5.0 ± 0.8 × 3.3 ± 0.4 µm); 1-septate conidia, obovoid, slightly constricted at septum, (4.5–)5.5–6.5(–9) × (2–)2.5–3.5(–4.5) µm (mean ± s.d. = 6.2 ± 1.0 × 3.1 ± 0.6 µm).

Discussion

Phaeoisaria sedimenticola is assigned to *Phaeoisaria* based on its typical indeterminate synnemata (Fig. 2b,c) with monomitic parallel stipe (Seifert & Okada 1990). Some synnematous hyphomycete genera, such as *Chryseidea* Onofri, *Dokmaia*, *Drumopama* Subram., *Geniculisynnema*, *Harpographium* Sacc., *Nodulisporium* Preuss, and *Phialophaeoisaria* Matsush. morphologically resemble *Phaeoisaria,* producing indeterminate synnemata, sympodial conidiogenous cells, and dry, usually aseptate, conidia (Seifert et al. 2011). They can be clearly separated from *Phaeoisaria* by their morphology. *Chryseidea*, *Dokmaia*, and *Phialophaeoisaria* differ from *Phaeoisaria* by their conidiogenous cells. *Chryseidea* and *Dokmaia* produce ampulliform (rather than cylindrical or clavate) conidiogenous cells (Promputtha et al. 2003; Onofri et al. 1981), whereas *Phialophaeoisaria* has phialidic or polyphialidic conidiogenesis (Matsushima 1995). *Drumopama* and *Harpographium* differ from *Phaeoisaria* by producing citriform (*Drumopama*) and fusiform to falcate (*Harpographium*) conidia (Seifert et al. 2011). *Geniculisynnema* is distinguished by antler-like synnemata and dichotomously branching conidiophores (Okane & Nakagiri 2007). The distinction between synnematous asexual stages of *Xylaria* (formerly classified in *Nodulisporium*) and *Phaeoisaria* is based on apically aggregated scars and rhexolytic conidial secession.

The taxonomic significance of the presence of synnemata must be evaluated on a case-by-case basis (Seifert & Okada 1990). Genera such as *Pleurothecium* Höhn. (anamorphic *Carpoligna*), *Ramichloridium* Stahel ex de Hoog, *Rhinocladiella* Nannf., and *Sporothrix* Hektoen & C.F. Perkins have denticulate sympodial conidiogenous cells (similar to *Phaeoisaria* species) but do not produce synnemata. *Phaeoisaria sedimenticola* was confused with *Pleurothecium* in early stages of cultivation, before synnemata appeared. In fact, *Pleurothecium* species typically have distinctive recurved sporogenous cells, with the production of successive conidia, i.e., "helicoid cyme" (Goos 1969). *Ramichloridium* and *Rhinocladiella* are distinguished by minute denticles on conidiogenous cells and also lack conidioma (Arzanlou et al. 2007). Some species of *Sporothrix* also resemble *Phaeoisaria*, but differ in cottony colonies and the absence of pigmentation from the fertile hyphae (de Hoog & Papendorf

1976). The morphological distinctions among all of these genera are also well supported by LSU rDNA sequence analyses. *Phaeoisaria sedimenticola* can be easily distinguished from previously described species of *Phaeoisaria* by its morphology. In comparison with *P. sedimenticola*, *P. clematidis* differs by its aseptate conidia, (4.5–)6–8(–10) × 1.5–4 µm (de Hoog & Papendorf 1976); *P. magnifica* differs by its very pale olivaceous, aseptate conidia, 5–6.5 × 4–4.5 µm (Deighton 1974); and *P. uniseptata* differs by its fusiform, elliptical to cylindrical conidia, usually 1-septate, 3.6–10.2 × 1.6–3.4 µm (Mercado 1984).

Acknowledgments

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Three new species of *Septobasidium* from Yunnan and Guangxi in China

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Abstract — Three new species are described: *Septobasidium brunneum* on *Eurya* sp. associated with *Chionaspis* sp., *Septobasidium guangxiense* associated with *Pseudaulacaspis* sp., and *Septobasidium transversum* associated with tribe *Lepidosaphidini*. They were collected from Yunnan Province and Guangxi Zhuang Autonomous Region in China.

Key words — *Pucciniomycetes*, *Septobasidiales*, *Septobasidiaceae*, taxonomy

Previously, 26 species of *Septobasidium* have been recorded in Yunnan and Guangxi of China. An additional three new species of *Septobasidium*, collected from these regions, are described as follows:

Septobasidium brunneum Wei Li bis & L. Guo, **sp. nov.** Figs 1–7

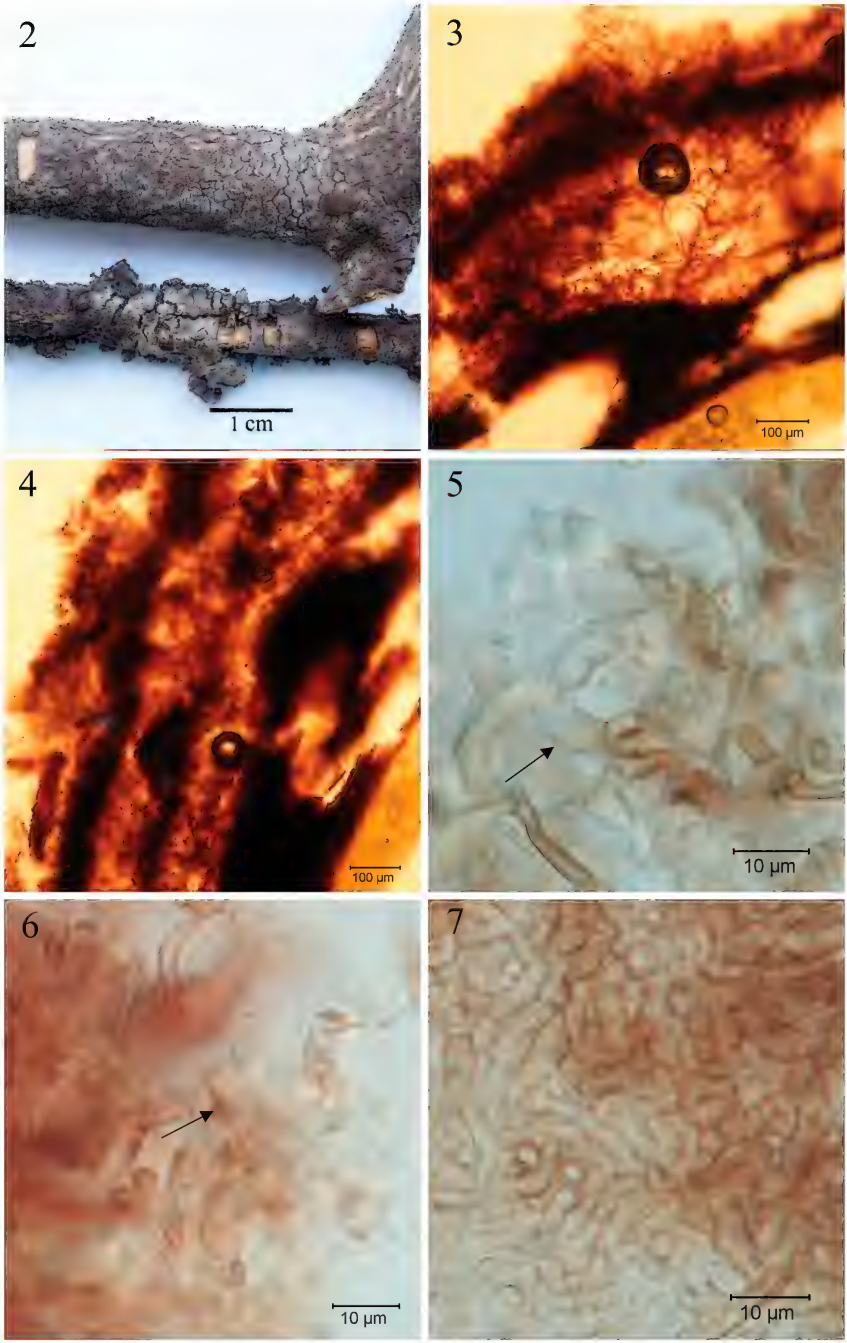
Fungal Name FN 570073

Differs from *Septobasidium thwaitesii* by its thinner section, smaller basidia, and absence of a horizontal section layer.

Type: China, Yunnan, Dali, Cangshan, on *Eurya* sp. *(Pentaphylacaceae)*, associated with *Chionaspis* sp. (*Diaspididae*), 11.VIII.2011, F. He YN45 (HMAS 243152, **holotype**).

Etymology: The epithet refers to the surface color of basidiomata.

Basidiomata on branches, resupinate, 7–9 cm long, 2–3 cm wide, dark brown or purple-brown; surface with many cracks, frequently extending out to form lateral margins in old stage, margin indeterminate. In section 350–700 μm thick. Subiculum brown, 30–50 μm thick. Pillars brown, 50–80 μm high, 80–150 μm wide. Hyphal layer brown, 150–220 μm high. Hymenium brown, 70–100 μm thick. The hyphae renew grown to form successive hyphal layers and hymenium from hymenial layer in old stage. Probasidia pyriform or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7
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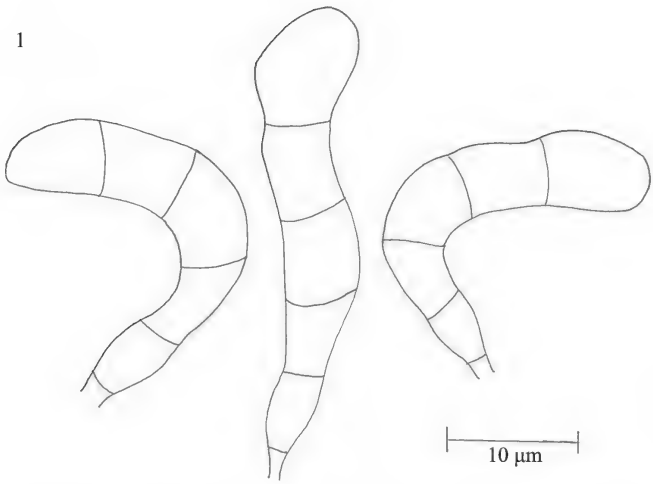


Fig 1. *Septobasidium brunneum* (HMAS 243152, holotype). Basidia.

subglobose, 10–15 × 7–9 µm, persistent. Basidia cylindrical, curved or straight, 4-celled, 20–30 × 4–6 µm, brown. Basidiospores not seen. Haustoria consisting of irregularly coiled hyphae.

Comments: *Septobasidium brunneum* is similar to *S. thwaitesii* (Berk. & Broome) Pat., which differs by having a thicker section (270–1500 µm), two distinct horizontal layers, and larger basidia (37–46 × 12–13.5 µm; Couch 1938).

Septobasidium guangxiense Wei Li bis & L. Guo, **sp. nov.** Figs 8–11

Fungal Name FN 570074

Differs from *Septobasidium ligustri* by its numerous fissures on the basidiome surface, its larger basidia, and its horizontal section layer.

Type: China, Guangxi, Wuming, Damingshan Scenic Area, alt. 700 m, on unidentified plant, associated with *Pseudaulacaspis* sp. (*Diaspididae*), 29.VIII.2011, W. Li & S.H. He 1519 (HMAS 244542, **holotype**).

Etymology: The epithet refers to the type locality, Guangxi.

Basidiomata on branches, resupinate, 40–50 cm long, 6–7 cm wide, yellowish brown or brown; surface with numerous fissures at maturity; margin determinate. In section 200–500 µm thick. Subiculum brown, 30–70 µm thick. Pillars brown, 70–100 µm high, 50–80 µm wide, forming a horizontal layer 20–40 µm thick on the top of pillars. Hyphal layer brown, 150–250 µm thick.

Figs 2–7. ***Septobasidium brunneum*** (HMAS 243152, holotype). 2. Basidiomata on branches; 3–4. Sections of basidiomata; 5–6. Basidia (arrows); 7. Haustoria.

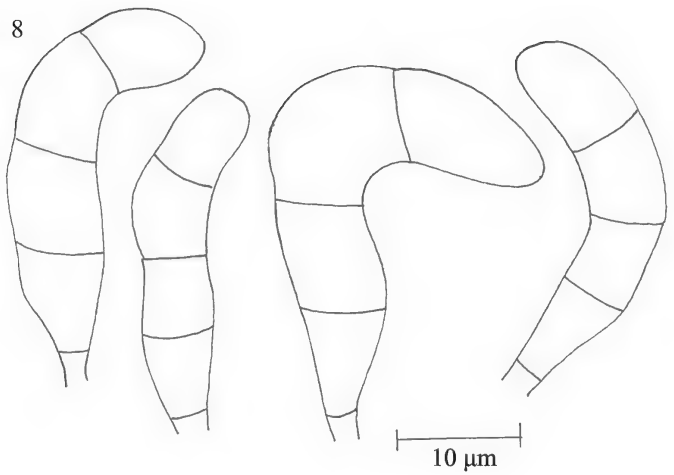


Fig 8. *Septobasidium guangxiense* (HMAS 244542, holotype). Basidia.

Hymenium brown, 50–100 μm thick, with irregularly arranged hyphae. Basidia arising directly from the hyphae without a probasidial cell, cylindrical, straight or curved, 4-celled, 27–38 × 5–10 μm, hyaline or brownish. Basidiospores not seen. Haustoria not seen.

Comments: *Septobasidium guangxiense* is similar to *S. ligustri* C.X. Lu & L. Guo, which differs by having fewer fissures on the basidiome surface, lacking a horizontal section layer, and having smaller basidia (15–29 × 5–7.5 μm; Lu & Guo 2010c).

Septobasidium transversum Wei Li bis & L. Guo, **sp. nov.** Figs 12–15

Fungal Name FN 570075

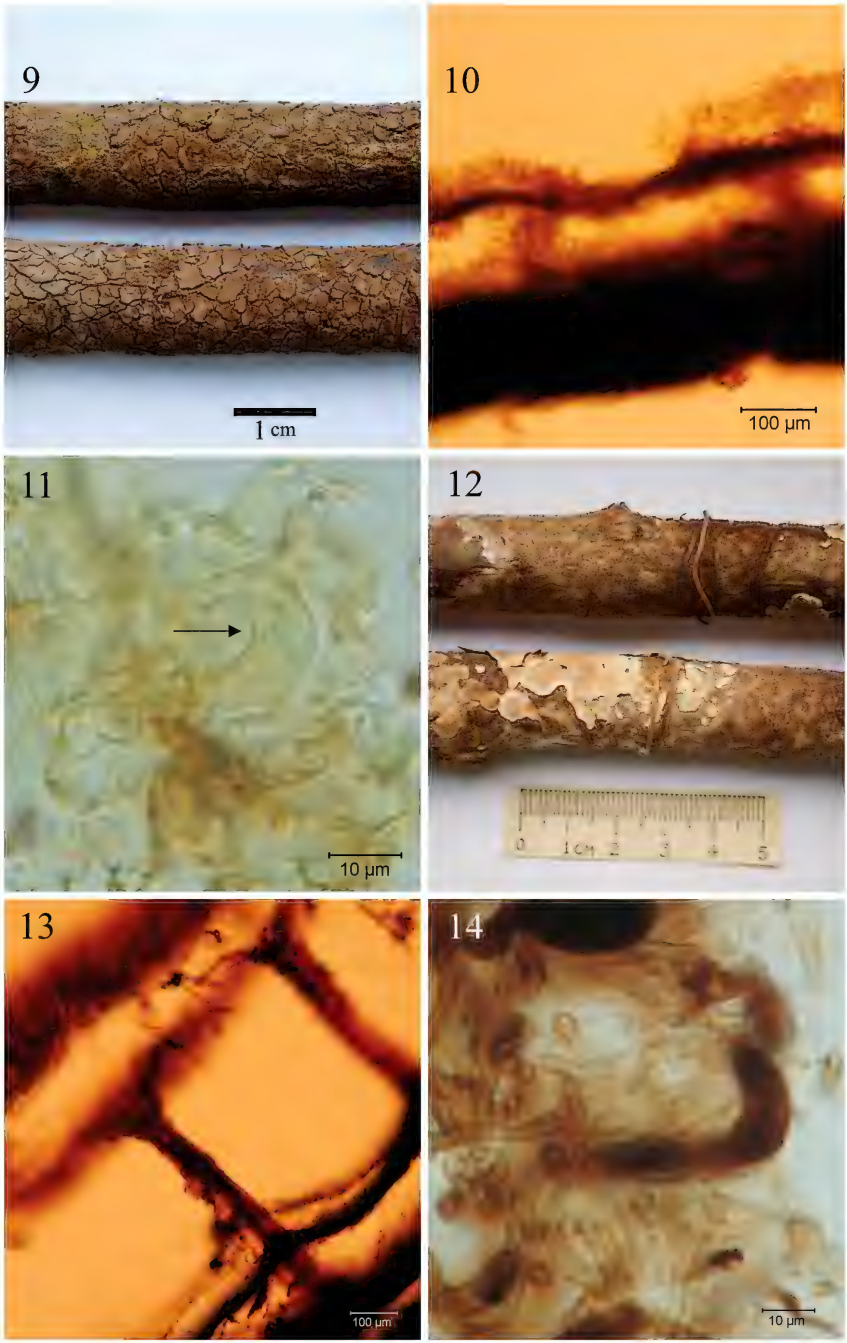
Differs from *Septobasidium pittospori* by its transverse layer at the pillar bases.

Type: China, Guangxi, Longzhou, Nonggang Natural Reserve, alt. 400 m, on unidentified plant, associated with tribe *Lepidosaphidini* (*Diaspididae*), 21.VII.2012, S.H. He GX02 (HMAS 244429, **holotype**).

Etymology: The epithet refers to the transverse layer running below the pillars in section.

Basidiomata on branches, resupinate, 14–28 cm long, 4–6 cm wide, pale cinnamon-brown, cinnamon-brown or brown; surface smooth, peeling off at

Figs 9–11. ***Septobasidium guangxiense*** (HMAS 244542, holotype). 9. Basidiomata on branches; 10. Section of basidioma; 11. Basidium (arrow). Figs 12–14. ***Septobasidium transversum*** (HMAS 244429, holotype). 12. Basidiomata on branches; 13. Section of basidioma; 14. Basidia.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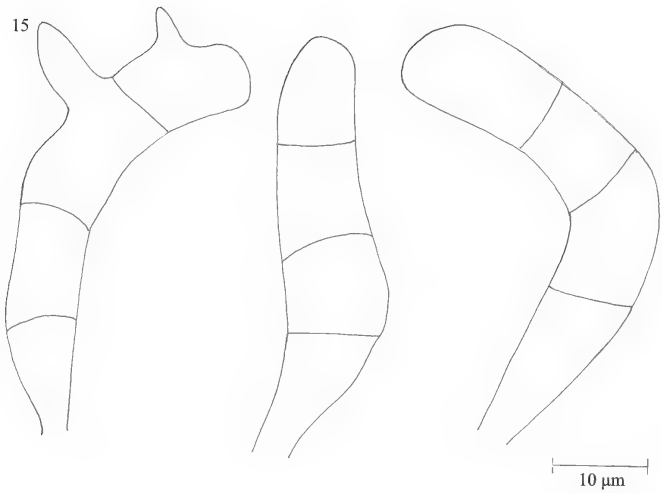

Fig 15. *Septobasidium transversum* (HMAS 244429, holotype). Basidia.

maturity, emerging pillars; margin determinate or indeterminate. In section 800–1200 μm thick. Subiculum brown, 30–100 μm thick. Pillars brown, 300–730 μm high, 50–190 μm wide, forming a transverse layer 20–60 μm thick at the pillar bases. Hyphal layer brown, 150–250 μm thick. Hymenium hyaline or brown, 70–120 μm thick. Basidia arising directly from the hyphae without a probasidial cell, cylindrical, straight or curved, 4-celled, 42–60 × 9–12 μm, hyaline or brown. Sterigmata conical, hyaline or brown. Basidiospores not seen. Haustoria consisting of irregularly coiled hyphae.

Comments: *Septobasidium transversum* is similar to *S. pittospori* C.X. Lu & L. Guo, which differs by having shorter pillars (190–290 μm), thicker hyphal layer (340–580 μm) in the section, and without a transverse layer at the base of pillars (Lu & Guo 2011).

Including the three new species reported in this paper, 57 *Septobasidium* species have now been reported in China (Sawada 1933, Couch 1938, Teng 1963, Tai 1979, Kirschner & Chen 2007, Lu & Guo 2009a,b,c, 2010a,b,c, 2011, Lu et al. 2010, Chen & Guo 2011a,b,c, 2012a,b,c, Li & Guo 2013a,b, Li et al. 2013).

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Conidial fungi from the semiarid Caatinga biome of Brazil: a new species of *Pseudoacrodictys*

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Abstract — *Pseudoacrodictys magnicornuata* sp. nov., collected on decaying twigs in the semiarid region northeastern Brazil, is described and illustrated. It is distinguished by turbinate, sub-napiform, subglobose to irregular, dictyoseptate, golden brown, brown to dark brown conidia with 7–35 corniform cellular appendages that are 1–2(–4) circinate and arranged around the conidial margin or apex.

Key words — asexual fungi, taxonomy, *Acrodictys*-like

Introduction

Baker & Morgan-Jones (2003) introduced the genus *Pseudoacrodictys* for seven species previously described under a broad generic concept of *Acrodictys*. These are distinguished from *Acrodictys* by more commonly indeterminate, cylindrical, doliiform to subulate enteroblastic percurrent elongations of the conidiogenous cells and schizolytic conidial secession; they produce conidia that are holoblastic, solitary, acrogenous, subglobose to broadly pyriform to turbinate or irregular, obscurely dictyoseptate and bear one to several (a)septate, somewhat hypha-like, straight, undulate, involute to uncinate cellular appendages. Four other species have also been described: *P. dimorphospora* Somrith. & E.B.G. Jones, *P. aquatica* R.F. Castañeda et al., *P. fici* Y.D. Zhang & X.G. Zhang, and *P. steviae* Rashm. Dubey & A.K. Pandey bis (Castañeda Ruiz et al. 2010, Dubey & Pandey 2012, Somrithipol & Jones 2003, Zhang et al. 2011). Recently an interesting *Pseudoacrodictys* specimen from Brazil,

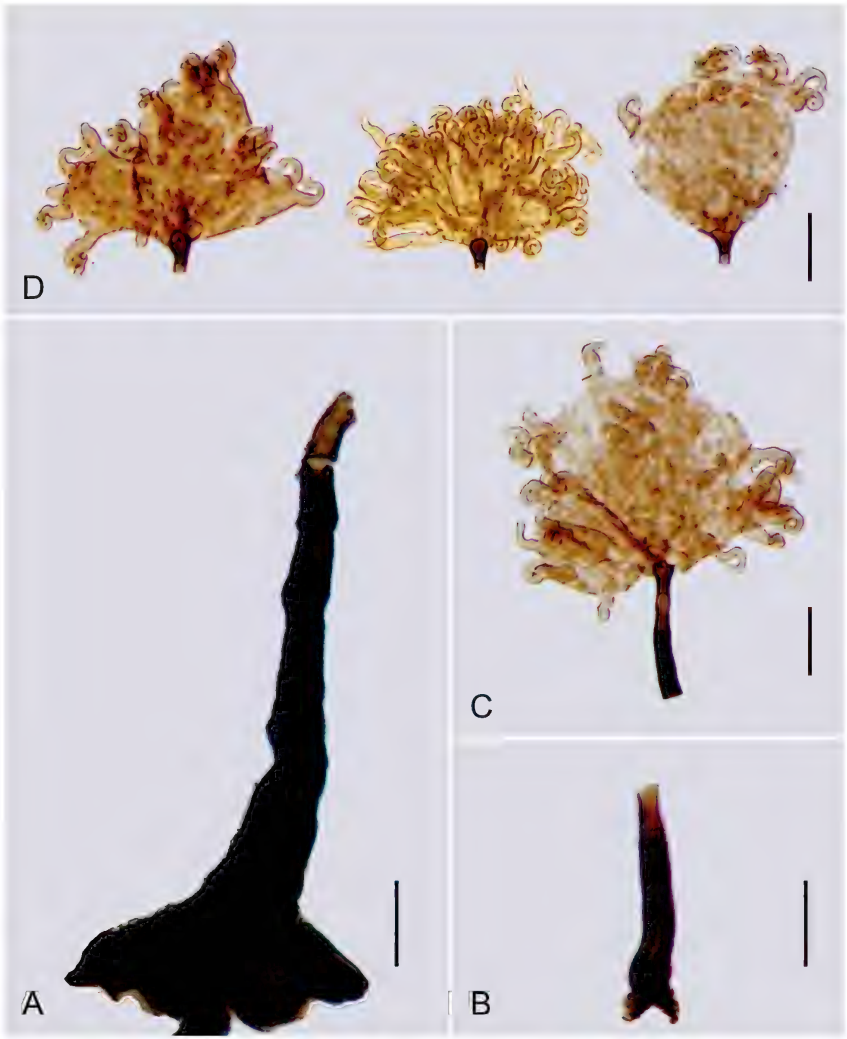

Fig. 1. *Pseudoacrodictys magnicornuata* (ex HUEFS 194255). A–B. Conidiophores and conidiogenous cells. C. Conidiogenous cell and conidium. D. Conidia. Scale bars: A–B = 10 µm; C–D = 20 µm.

morphologically distinct from all previously described species, has been discovered and is here described as new.

During several July 2007–May 2009 expeditions through "Serra da Jibóia" in the semiarid region northeastern Brazil, samples of lignified plant debris were collected, taken to the laboratory, and treated according to Castañeda

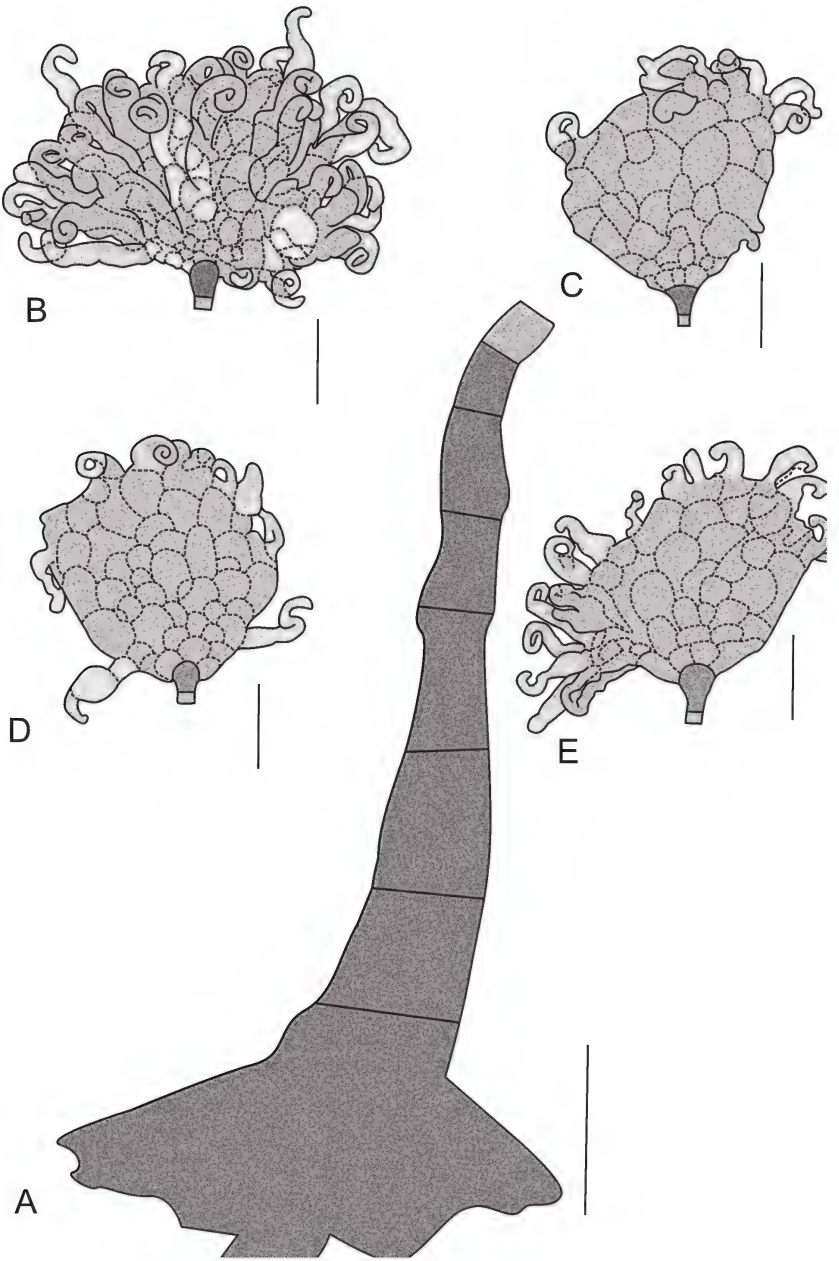

Fig. 2. *Pseudoacrodictys magnicornuata* (ex HUEFS 194255).
A. Conidiophore. B–E. Conidia. Scale bars: A = 15 μm; B–D = 20 μm.

Ruiz (2005). Mounts were prepared in PVL (polyvinyl alcohol, lactic acid, and phenol) and measurements made at a magnification of ×1000. Micrographs were obtained with an Olympus microscope (model BX51) with bright field and Nomarski interference optics. The type specimen of the new species is deposited in the Herbarium of "Universidade Estadual de Feira de Santana" (HUEFS).

Taxonomy

Pseudoacrodictys magnicornuata Fiuza, Gusmão & R.F. Castañeda, **sp. nov.**

Plate. 1, 2

MycoBank MB805080

Differs from other *Pseudoacrodictys* species by its multi-appendiculate conidia with corniform, circinate, cellular appendages arising around the margin or towards the apex of the conidium.

Type: Brazil, Bahia, Santa Terezinha, Serra da Jibóia, 12°51′23.1″S 39°28′ 33″W, on decaying twigs, 11-V-2009, coll. P.O. Fiuza- (**Holotype**: HUEFS 194255).

Etymology: Latin, *magni-* meaning major, large + *-cornuata* for the coiled or circinate horn-shaped cellular conidial appendages.

Colonies on the natural substratum effuse, brown to black. Mycelium mostly immersed. Conidiophores distinct, single, erect, straight or flexuous, unbranched, 3–5-septate, smooth, dark brown to black. Conidiogenous cells monoblastic, integrated, indeterminate, with 3–5 subulate enteroblastic percurrent elongations, smooth, dark brown. Conidial secession schizolytic. Conidia solitary, turbinate, sub-napiform, subglobose to irregular, finely ruminate dictyoseptate, golden brown, brown to dark brown, 50–87 × 50–67 µm, multi-appendaged, with 9–35 cellular appendage, corniform, 1–2 (–4)-times coiled or circinate, each appendage 1–4-septate, brown to pale brown, 18–50 × 4.0–7.5 µm, scattered around the margin or towards the apex of the conidium.

Note: The conidial appendages of *Pseudoacrodictys magnicornuata* are unique among *Pseudoacrodictys* species (Table 1) in being circinate.

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Table 1. *Pseudoacrodictys* species with appendaged conidia

Species	Conidial shape	Conidial size (µm)	Appendages		
			Number	Length	Shape
P. appendiculata	Pyriform to turbinate	27–45 × 22–30	2–3	56 µm	Subulate
P. corniculata	Globose, subglobose to broadly pyriform	19–35 × 17–30	3–4	8–20 µm	Subulate and curved
P. eickeri	Pyriform to turbinate	28–64 × 22–42	3–4	7–12 µm	Cylindrical
P. fici	Subglobose, sometimes lobed	35–52 × 22–44	2–4	30–70 µm	Cylindrical
P. magnicornuata	Turbinate, sub-napiform, subglobose, or irregular	50–87 × 50–67	9–35	18–50 µm	Circinate
P. viridescens	Globose, subglobose to broadly pyriform	62–80 × 40–60	4–6	8–20 µm	Cylindrical

assistance provided by Dr. P.M. Kirk and Drs. V. Robert and G. Stegehuis through the IndexFungorum and Mycobank websites. Dr. Lorelei L. Norvell's editorial and Dr. Shaun Pennycook's nomenclatural reviews are greatly appreciated.

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Two new microfungi from Brazilian Amazon Forest: *Atrogeniculata submersa* and *Nigrolentilocus amazonicus*

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Abstract — *Atrogeniculata submersa* gen. & sp. nov. and *Nigrolentilocus amazonicus* sp. nov., collected on the submerged decaying leaves of an unidentified plant, are described and illustrated. *Atrogeniculata submersa* is distinguished by macronematous geniculate conidiophores, mono- and polyphialidic integrated indeterminate conidiogenous cells, and solitary aseptate globose pyriform to broadly ellipsoid conidia that are at first subhyaline but mature to reddish-brown to dark brown and secede schizolytically on a collarette. *Nigrolentilocus amazonicus* is characterized by solitary acropleurogenous obclavate conidia that are 2-septate and brown below and subhyaline to pale brown at the apex.

Key words — asexual fungi, systematics, tropical fungi

Introduction

Saprobic dematiaceous hyphomycetes are highly diverse on plant material in tropical forests and semi-arid regions, where many new genera or species have recently been discovered (e.g., Almeida et al. 2013, Castaneda Ruiz et al. 2009, 2012, Cruz et al. 2012, Ma et al. 2011, Monteiro & Gusmao 2013, Ren et al. 2012, Silva & Gusmao, 2013, Zhang et al. 2009, 2011). Taking into account its highly variable geographical and physical conditions, the Brazilian Amazon is considered an important reservoir of biodiversity. However, its mycobiota, especially of microfungi, is poorly known. During a mycological survey of fungi associated with submerged litter at Brazilian Amazon forest,

two interesting fungi were collected from submerged leaves in a stream. One showed remarkable differences from all previously described hyphomycete genera (Seifert et al. 2011) and the other from all *Nigrolentilocus* species (Castañeda-Ruiz et al. 2001). The two fungi are therefore described here as new.

Materials & methods

Samples of submerged litter were placed in paper and plastic bags, taken to the laboratory, and prepared according to Castañeda-Ruiz (2005). Mounts were prepared in PVL (polyvinyl alcohol, lactic acid, and phenol) and measurements were made at a magnification of ×1000. Micrographs were obtained with an Olympus BX51 microscope equipped with bright field and Nomarski interference optics. The type specimen is deposited in the Herbarium of Universidade Estadual de Feira de Santana (HUEFS).

Taxonomy

Atrogeniculata J.S. Monteiro, Gusmão & R.F. Castañeda, **gen. nov.**

MycoBank MB805084

Differs from *Phialogeniculata* by its reddish-brown to dark conidia, from *Phaeohiratsukaea* by its solitary conidia that lack a longitudinal germ slit, and from *Craspedodidymum* by its intercalary sympodially elongated conidiogenous cells.

Type Species: *Atrogeniculata submersa* J.S. Monteiro et al.

Etymology: *Atro-*, referred to the dark conidial pigmentation + *-geniculata*, referring to the bent conidiophores.

Asexual fungi. Colonies on the natural substratum, hairy, golden brown to brown. Mycelium superficial and immersed. Conidiophores macronematous, mononematous, erect, geniculate, septate, brown to dark brown. Conidiogenous cells monophialidic or polyphialidic, integrated, indeterminate, intercalary and terminal, with a conspicuous collarette. Conidial secession schizolytic. Conidia solitary, acropleurogenous, aseptate, ellipsoid, ovoid, globose to oblong, first hyaline, later brown, reddish brown to black, smooth or verruculose.

Note: *Atrogeniculata* superficially resembles *Phialogeniculata* Matsush., but *Phialogeniculata* has hyaline conidia that aggregate in white mucous masses (Matsushima 1971, 1993, Hyde et al. 1998). *Atrogeniculata* also resembles *Phaeohiratsukaea* Udagawa & Iwatsu, but *Phaeohiratsukaea* has pale brown or brown basocatenulate conidia with a conspicuous longitudinal germ slit (Udagawa & Iwatsu, 1990). *Craspedodidymum* Hol.-Jech. (Holubová-Jechová 1972, Yanna et al. 2000) and *Atrogeniculata* have a similar conidial ontogeny with the conidia produced through funnel-shaped collarettes, but in *Craspedodidymum* the conidiogenous cells are apical and not intercalary.

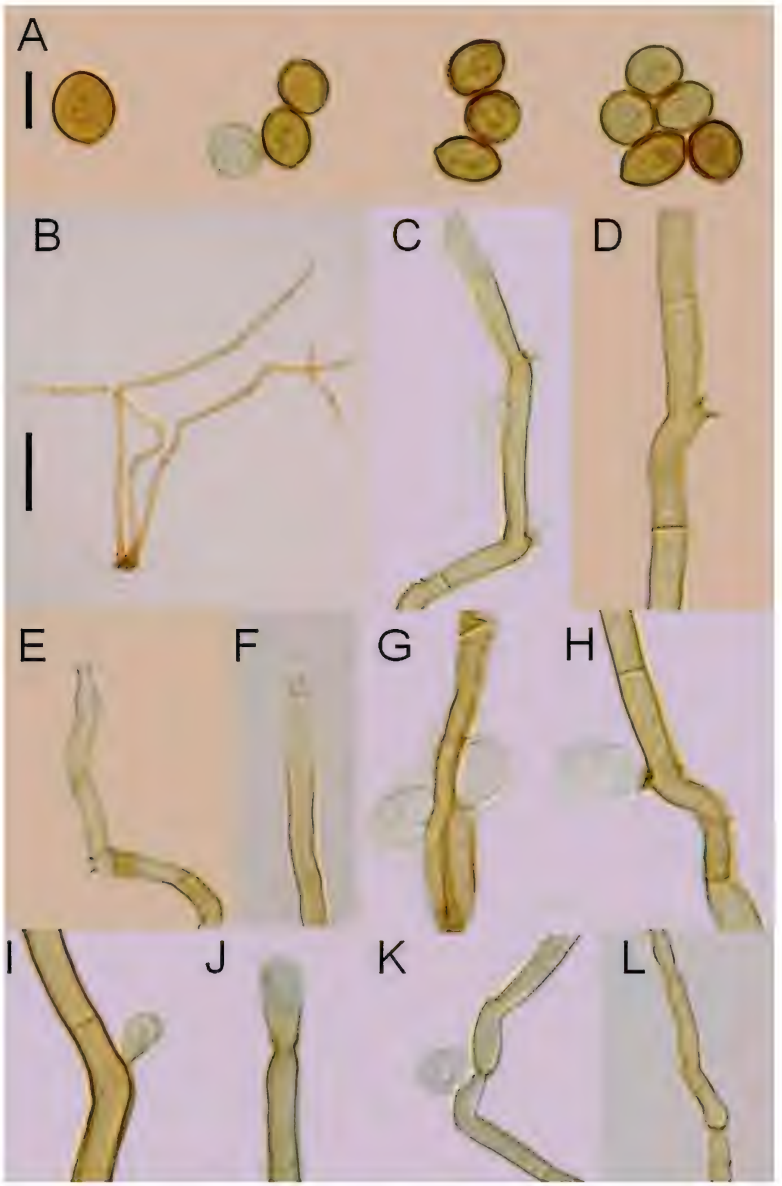

Fig. 1. *Atrogeniculata submersa* (HUEFS 196428). A. Conidia. B. Conidiophores. C–L Conidiogenous cells, collarettes, and young conidia. Scale bars: A, C–L = 10 µm; B = 20 µm.

Atrogeniculata submersa J.S. Monteiro, Gusmão & R.F. Castañeda, **sp. nov.** Fig. 1

MycoBank MB805085

Differs from *Phialogeniculata* species by having brown to reddish brown, aseptate conidia and from *Phaeohiratsukaea expansa* by its solitary conidia without longitudinal germ slit.

Type: Brazil, Pará State, Belém, Parque Estadual do Utinga, 1°25′S 48°27′W, on submerged decaying leaves of an unidentified plant in a stream, 28 October 2011, coll. J.S. Monteiro (**Holotype**: HUEFS 196428).

Etymology: Latin, *submersa*, meaning submerged, growing under water.

Colonies on the natural substratum, hairy, epiphyllous, golden brown to brown. Mycelium superficial and immersed, composed of septate, branched, brown, smooth, 1–3 µm diam hyphae. Conidiophores macronematous, mononematous, erect, geniculate, 7–15-septate, brown to golden brown, smooth, 60–200 × 5–8 µm. Conidiogenous cells monophialidic, rarely polyphialidic with sympodial extensions, sometimes with enteroblastic percurrent elongations, integrated, indeterminate, intercalary and terminal, brown to golden brown, 39–60 × 2.5–4.0 µm, with several conspicuous funnel-shaped or infundibuliform, 2–3 µm diam, 2.0–3.5 µm deep collarettes, more or less at the middle of each intercalary conidiogenous cell and at the apex of each terminal conidiogenous cell. Conidial secession schizolytic. Conidia solitary, acropleurogenous, aseptate, ellipsoid, ovoid, globose to ellipsoid, but frequently slightly apiculate, with inconspicuous hilum at the base, successively produced, hyaline at first, brown to reddish brown after maturation, smooth, 10–12 × 7–9 µm, dry.

Nigrolentilocus amazonicus J.S. Monteiro, Gusmão & R.F. Castañeda, **sp. nov.** Fig. 2

MycoBank MB805086

Differs from all other *Nigrolentilocus* species by its 2-septate, obclavate to obpyriform conidia.

Type: Brazil, Pará State, Belém, Área de Preservação Ambiental Ilha do Combu, 1°29′S 48°25′W, on submerged rotten leaves of unidentified plant in stream, 05.IV.2011, coll. J.S. Monteiro (**Holotype**: HUEFS 196429).

Etymology: Latin, *amazonicus*, referring to the type locality.

Colonies on the natural substratum, effuse, hairy, amphigenous, dark brown to black. Mycelium mostly immersed. Hyphae septate, branched, 1–2 µm diam., smooth, brown. Conidiophores macronematous, mononematous, erect, straight, sometimes slightly sinuate towards the apex, unbranched, 5–10-septate, with several annellations, smooth, 50–150 × 5–8 µm, brown to dark brown at the base, brown towards the apex. Conidiogenous cells

Fig. 2. *Nigrolentilocus amazonicus* (HUEFS 196429). A. Conidiophore, conidiogenous cells, and conidia. B–C. Conidiogenous cells. D. Conidia. Scale bar = 20 μm.

polyblastic, terminal and intercalary, brown, 39–70 × 4–5 μm, integrated, indeterminate, with several sympodial elongations bearing conspicuous, lenticular, black conidiogenous loci after enteroblastic percurrent elongations. Conidial secession schizolytic. Conidia solitary, obclavate to obpyriform, obscure cicatrized at the base, obtuse at the apex, acropleurogenous, smooth, dry, 2-septate, 15–20 × 6.0–6.5 μm, with basal and central cells brown and apical cell pale brown.

Note: Castañeda-Ruiz et al. (2001) established the genus *Nigrolentilocus*, with *N. africanus* (B. Sutton) R.F. Castañeda & Heredia as type species to accommodate one new species and four species previously treated in *Pseudospiropes* M.B. Ellis and *Helminthosporium* Link. None of the five previously described *Nigrolentilocus* species, which are easily differentiated from each other, is close to or resembles *N. amazonicus*.

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A new rust on *Tragopogon* from Rhodes, Greece

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Abstract — *Puccinia rhodosensis* sp. nov. is described on *Tragopogon crocifolius* from Rhodes, Greece. It differs from all other rust species on *Tragopogon* in having teliospores with completely smooth walls. SEM photos are provided for telia and teliospores.

Key words — biodiversity, fungi, taxonomy, *Uredinales*

Introduction

When scrutinizing an old collection of phanerogams from Rhodes on a *Tragopogon* specimen, we came across a *Puccinia* rust that did not correspond with any *Puccinia* species recorded on this host genus. We therefore publish it as a new species. SEM photos are provided for telia and teliospores.

Taxonomy

Puccinia rhodosensis Gjærum, **sp. nov.** Plates 1–2

MycoBank 805646

Differs from other *Puccinia* species on the genus *Tragopogon* by its smooth teliospores.

Type: Greece, Rhodes, Lindos, on roadside, 36°05 35 N 28°05 26 E, on leaves and stems of *Tragopogon crocifolius* L. (*Asteraceae*), 8 May 1990, K. A. Lye 15143 (**holotype**, NPPI; **isotype**, O).

Etymology: from Latin *Rhodus* and Greek *Rhodos;* the adjective *rhodosensis* = from Rhodes

Pycnia, aecia and uredinia not seen. Telia on leaves and stems, singular or in small groups, surrounded by the ruptured epidermis, dark brown. Teliospores mostly ellipsoid, slightly constricted at septum, 15–21 × (13–)15–19 µm. Wall

Plate 1. *Puccinia rhodosensis* (holotype).
Two telia filled with teliospores on stem of *Tragopogon crocifolius*.

Plate 2. *Puccinia rhodosensis* (holotype). Teliospore.

light brown, smooth, 1.5–2 µm thick, pores with low papillae, upper pore apical, lower pore depressed. Pedicel broken near the spore, hyaline. Parasitic on stems and leaves of *Tragopogon crocifolius* L.

NOTES: Two other *Puccinia* rusts on the genus *Tragopogon* — *P. hysterium* (F. Strauss) Röhl. (= *Puccinia tragopogonis* Corda) and *P. hysterium* subsp. *brachycyclica* (E. Fisch.) T. Majewski — differ from *P. rhodosensis* by their verrucose teliospores (Majewski 1979). Another *Puccinia* rust recorded on *Tragopogon*, *P. tranzscheliana* I. E. Brezhnev, differs by producing only aecidia on *Tragopogon,* with uredinia and telia on alternate *Carex* hosts (Brezhnev 1949).

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The lily magnolia powdery mildew *Erysiphe magnifica* found in Slovakia

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Abstract — Powdery mildew symptoms were observed on leaves of lily magnolia (*Magnolia liliiflora*) in Slovakia. The causal fungus was identified as *Erysiphe magnifica* based on the morphology of both anamorphic and teleomorphic stages. This is the first report of *E. magnifica* on lily magnolia in Slovakia. A detailed description, illustrations, the host range, and the distribution of this fungus are given.

Key words — *Magnoliaceae*, *Erysiphales*, morphology

Introduction

The genus *Magnolia* L. is represented by around 100 species of deciduous and evergreen trees or shrubs as well as countless cultivars and occurs naturally throughout Asia, North America, and Central and South America (Horáček 2005). According to the last comprehensive survey of *Magnolia* in Slovakia conducted in the early 1980s (Benčať 1982), the most commonly grown species is *Magnolia* ×*soulangeana* Soul.-Bod. (*M. denudata* × *M. liliiflora*), while seven other species — *M. acuminata* (L.) L., *M. denudata* Desr., *M. kobus* DC., *M. liliiflora* Desr., *M. obovata* Thunb., *M. salicifolia* (Siebold & Zucc.) Maxim., and *M. tripetala* (L.) L. — are rare in the country. Recently, these species have become more abundant in Slovakia with plantings introduced to private gardens and parks (Reháčková 2009).

Erysiphe magnifica, a common powdery mildew fungus occurring on *Magnolia* spp. in North America and Asia (Braun 1987), has recently been introduced to Europe. In Europe, this fungus has previously been recorded from Germany and Switzerland (Braun et al. 2009), the Netherlands (Pijpers 2009), Italy (Maspero & Tantardini 2011), United Kingdom (Cook et al. 2011), and Ukraine (Chumak et al. 2012). Wolcan & Murace (2009) also report *E. magnifica* from South America.

Erysiphe magnifica is not included in the checklist of fungi of Slovakia (Lizoň & Bacigálová 1998) nor in the monograph of powdery mildews of Slovakia (Paulech 1995). In 2008, a powdery mildew specimen on magnolia was collected in Slovakia and identified as *E. magnifica* based on the morphological characteristics of its anamorph and teleomorph. We describe and illustrate this collection and compare *E. magnifica* with other powdery mildews on magnolias.

Materials & methods

In 2008, lily magnolia leaves with symptoms of a powdery mildew disease were collected in Beladice village, western Slovakia. Samples were examined under an Olympus SZ61 stereomicroscope and Olympus BX51 compound microscope. Measurements were made in distilled water using oil immersion, without any staining. The observed morphological features were compared to previously published descriptions of the species. The fungus was photographed using a digital camera Olympus E410 and Quick Photo Micro (version 2.2) and Deep Focus 3.1 software. Representative material was deposited in the mycological herbaria of Institute of Forest Ecology of SAS, Nitra, Slovakia (NR) and Institute of Botany of SAS, Bratislava, Slovakia (SAV).

Taxonomy

Erysiphe magnifica (U. Braun) U. Braun & S. Takam., Schlechtendalia 4: 10, 2000.

PLATE 1

≡ *Microsphaera magnifica* U. Braun, Mycotaxon 16(2): 418, 1983.

Mycelium amphigenous, forming irregular white patches or effuse. Hyphae septate, hyaline, irregularly branched. Appressoria solitary or in opposite pairs, nippled-shaped to lobed. Conidiophores erect, 65–114 µm long, arising mostly centrally from top of the hyphal mother cell, foot cells straight, rarely curved at the base, followed by 1–3 shorter cells producing conidia singly, *Pseudoidium* type. Conidia solitary, hyaline, without fibrosin bodies, primary conidia ellipsoid-ovoid, apex rounded, base subtruncate, secondary conidia doliiform, both ends subtruncate, 22–38 × 13–18 µm (l/w = 1.6–2.4); conidial germ tubes subterminal, ending in a lobed appressorium. Chasmothecia scattered, globose, dark brown to blackish, 95–145 µm in diam., peridial cells conspicuous, irregularly polygonal, 10–25(–30) µm wide. Appendages hyaline, pale brownish at the base, aseptate, more or less equatorial, 8–14 in number, straight to curve, 90–142 µm long (i.e., 0.75–1.5 times as long as the chasmothecial diam.), and 7–15 µm broad, apex 4–6 times regularly dichotomously branched, tips of the ultimate branchlets recurved to uncinate. Asci 4–5 per chasmothecium, 59–81 × 40–54 µm, broadly ellipsoid-obovoid, saccate, narrowed towards the base, short stalked or sessile, containing 3–6 ascospores. Ascospores hyaline, ellipsoid-ovoid, 24–34 × 13–22 µm (l/w = 1.4–2.2).

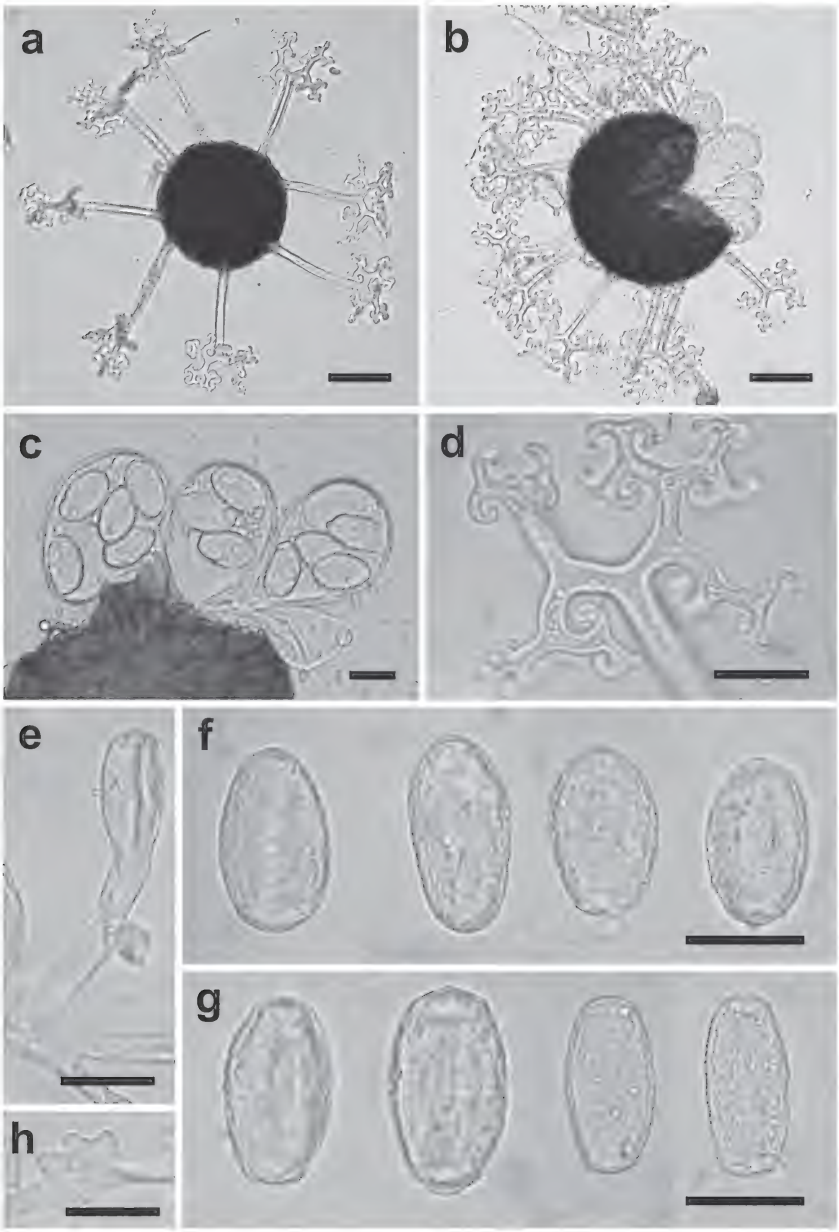

Plate 1. *Erysiphe magnifica* (SAV K1768). a, b: Chasmothecia; c: Asci with ascospores; d: Apex of appendage; e: Conidiophore; f: Primary conidia; g: Secondary conidia; h: Hyphal appressoria. Scale bars: a, b = 50 µm; c–h = 20 µm.

Specimen examined — **SLOVAKIA. Nitra**, Zlaté Moravce District, Beladice, Park Hotel Tartuf, on leaves of *Magnolia liliiflora*, 27 Aug. 2008, leg. G. Juhásová (NR 5068, SAV K1768).

Notes — The first conspicuous signs of *M. liliiflora* leaf damage by powdery mildew disease were recorded in the park around Hotel Tartuf in Beladice in late July 2002 (no specimen preserved). Subsequently the disease appeared annually at that site. Upper leaf surfaces were lightly covered by a soft white mycelium. In August 2008 we observed well developed mycelium with mature chasmothecia. The dense grayish white mycelium mostly covered the entire leaf blade surfaces. Almost all leaves of the shrubs were infected, and the heaviest infections were seen at the bottom of the shrubs. Despite the heavy infection, noticeable discoloration of host leaves was not observed.

This is the first record of *E. magnifica* from Slovakia. In Table 1, we compare the diagnostic morphological characteristics of our specimen with published data from German, North American, and Korean collections of *E. magnifica*.

Table 1. Biometric characteristics of *Erysiphe magnifica* on *Magnolia liliiflora* from Slovakia compared with previous descriptions

	Slovakia	Germany (Kirchner 2010)	USA (Glawe 2003)	Korea (Shin 2000)
Chasmothecia diam. (µm)	95–145	96–135(–144)	75–156	88–120
Appendages				
Number	8–14	6–14	Not given	7–13
Length (multiple of chasmothecial diam.)	0.75–1.5	0.7–1.5	Not given	0.8–1.4
Ascus dimensions (µm)	59–81 × 40–54	53–67 × 38–48	47–63 × 40–48	44–60 × 34–42
Ascospores				
Number per ascus	3–6	2–6	3–6	4–6
Dimensions (µm)	24–34 × 13–22	23–33 × 13–15	21–27.5 × 12–17	22–28 × 12–14
Conidiophores Length (µm)	65–114	Not given	Not given	70–120
Conidia Dimensions (µm)	22–38 × 13–18	25–31 × 10–14	24–32.5 × 12–16.5	27–38 × 13–16

Discussion

Five powdery mildew species — *Erysiphe aquilegiae* DC., *E. bulbosa* (U. Braun) U. Braun & S. Takam., *E. magnifica*, *E. magnoliae* (Sawada) U. Braun & S. Takam., *Phyllactinia magnoliae* Y.N. Yu & S.J. Han — have been reported as occurring on *Magnolia* spp. (Braun & Cook 2012), of which three are placed in *Erysiphe* sect. *Microsphaera*: *E. bulbosa*, *E. magnifica*, and *E. magnoliae*.

Erysiphe bulbosa differs from *E. magnifica* by the bulbous base of its chasmothecial appendages, while *E. magnoliae* is distinguished by chasmothecial

appendages that are much longer relative to the chasmothecial diameter and which have straight, pointed, or subclavate tips on their ultimate branchlets. Moreover, *E. magnifica* is the only species of *Erysiphe* sect. *Microsphaera* recorded from Europe on magnolias; *E. bulbosa* and *E. magnoliae* have been recorded only from Asia (Amano 1986, Braun & Cook 2012, Kobayashi 2007).

Table 2 summarises literature records of magnolias hosting *E. magnifica*. These records, from areas with climates ranging from subarctic (USA: Alaska) to humid subtropical (Argentina), demonstrate that *E. magnifica* can live in extremely different environments. *Erysiphe magnifica* has also been recorded from a non-magnoliaceous host, *Nelumbo nucifera* Gaertn. (*Nelumbonaceae*) (Kirschner 2010).

Table 2. Global distribution of *Magnolia* species attacked by *Erysiphe magnifica*

Geographic region		*Magnolia* taxa	References
Asia	Japan	*kobus*, *liliiflora*	Nomura 1997
	Korea	*kobus*, *liliiflora*, *obovata*, *ovata*, *sieboldii*	Shin 2000, Cho & Shin 2004
Europe	Germany	*liliiflora*	Kirschner 2010
	Italy	×*soulangeana*	Maspero & Tantardini 2011
	Netherlands	×*soulangeana*, *stellata*	Pijpers 2009
	Slovakia	*liliiflora*	This paper
	Switzerland	*kobus*, *liliiflora*, *liliiflora* var. *nigra*	Braun et al. 2009
	Ukraine	*acuminata*, *ashei*, *kobus*, *liliiflora*, ×*loebneri*, *obovata*, *salicifolia*, *sieboldii*, ×*soulangeana*, *sprengeri*, *stellata*, *tripetala*	Chumak et al. 2012
	UK	×*soulangeana*	Cook et al. 2011
North America	Canada	×*soulangeana*	Elmhirst 2013
	USA	*acuminata*, *grandiflora*, *liliiflora*, ×*soulangeana*, *stellata*	Braun 1983, 1987; Amano 1986, Saenz & Taylor 1999, Shin 2000, Glawe 2003
South America	Argentina	*liliiflora*	Wolcan & Murace 2009

Old Italian collections of the powdery mildews on *Magnolia pumila* Andrews (= *Magnolia liliifera* (L.) Baill.) have been assigned to *Erysiphe polygoni* DC. (Ciferri & Camera 1962) and *Erysiphe communis* (Wallr.) Schltdl. (Amano 1986). The status of these records is unclear. The identity of a North American record of *Uncinula bivonae* Lév. (nom. illegit., currently regarded as a synonym of *Erysiphe ulmi* Castagne var. *ulmi*) on *M. acuminata* (Amano 1986) is likewise unclear, since material was not available for examination. *Microsphaera penicillata* (Wallr.) Sacc., recorded from the USA on *M. liliiflora* and *M. stellata* (Siebold & Zucc.) Maxim. by Ellett (1966), very probably refers

to *E. magnifica*. Boesewinkel (1979) recorded *Oidium* sp. on *Magnolia* sp. in New Zealand but did not provide a description. McKenzie & Dingley (1996) also recorded only a powdery mildew anamorph of the *Pseudoidium* type (described as *Microsphaera* sp.) on *M. quinquepeta* (Buc'hoz) Dandy in New Zealand. We had no opportunity to examine the above collections to determine whether any represents *M. magnifica*.

According to Braun (1987), *E. magnifica* is morphologically close to *E. ornata* (U. Braun) U. Braun & S. Takam. var. *ornata* on *Betula* (*Betulaceae*) and *E. pseudopusilla* U. Braun & S. Takam. on *Euonymus* (*Celastraceae*), but their host preferences clearly differentiate these three species.

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Diplococcium variegatum, a new conidial fungus from the semi-arid Caatinga biome of Brazil

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Abstract — *Diplococcium variegatum* sp. nov., found on a decaying leaf of an unidentified plant, is described and illustrated. It is characterized by variegated pigmented structures and limoniform to ovoid, 0-septate, pale brown, brown to dark brown conidia in acropetal chains.

Key words — hyphomycetes, plant debris, taxonomy

Introduction

During surveys for conidial fungi on plant debris in a semi-arid region of northeast Brazil, an interesting specimen of *Diplococcium* Grove was found. The fungus clearly differs morphologically from all described species and is therefore described as new.

Materials & methods

Expeditions to Serra da Jibóia, Bahia, Brazil were made every 3 months, from October 2008 to April 2009. Samples of plant debris (twigs, bark, leaves, and petioles) were collected in paper bags. In the laboratory the samples were placed in Petri dish moist chambers and stored in a 170 L polystyrene box with 200 mL sterile water plus 2 mL glycerol at 25°C for 30 days (Castañeda-Ruiz 2005). During this period, the samples were examined for the presence of conidial fungi. Slides were prepared in polyvinyl alcohol plus lactic acid and phenol. Measurements were made at a magnification of ×1000. Micrographs were obtained with an Olympus BX 51.

Taxonomy

Diplococcium variegatum S.S. Silva, Gusmão & R.F. Castañeda, **sp. nov.** Fig. 1

MycoBank MB 805030

Differs from *Diplococcium parcum* by larger limoniform to ovoid conidia and the variably colored conidiogenous cells.

Type: Brazil. Bahia State: Santa Teresinha, Serra da Jibóia, on decaying leaves of an unidentified plant, 19.II.2009; coll. S.S. Silva. (**Holotype**: HUEFS 194254).

Etymology: Latin, *variegatum*, referring to the variable coloration of the conidiogenous cells and conidia.

Colonies effuse, hairy, brown. Mycelium superficial and immersed in substrate. Conidiophores macronematous, mononematous, erect, straight to slightly flexuous, simple or branched, 4–7-septate, smooth, brown below, variegated pigmented towards the apex, 135–189 × 12.0–16.5 µm, cell basal lobed 21–45 µm wide. Conidiogenous cells polytretic, integrated, terminal and intercalary, pale brown to dark brown to reddish brown, 19.5–25 × 5.0–6.5 µm. Conidia limoniform to ovoid, unicellular, smooth, thick-walled, pale brown to dark brown or reddish brown, 7.5–22.5 × 5–12 µm, forming acropetal chains. Teleomorph unknown.

Note: *Diplococcium* was described by Grove (1885) with the type species *D. spicatum* Grove from dead wood in England. Braun et al. (1996), Castañeda-Ruiz & Kendrick (1991), Cruz et al. (2007), Goh & Hyde (1998), Hernández-Restrepo et al. (2012), Ma et al. (2012), Pirozynski (1972), and Wang & Sutton (1998) documented 28 accepted species of *Diplococcium*, which are characterized by terminal or intercalary polytretic conidiogenous cells that produce 0–7-septate conidia in acropetal chains. *Diplococcium capitatum* Piroz., *D. hughesii* C.J.K. Wang & B. Sutton, and *D. parcum* Hol.-Jech. are also species that produce exclusively aseptate conidia. *Diplococcium capitatum* differs from *D. variegatum* by conidiogenous pores confined to a swollen terminal cell that produces short cylindric or broadly ellipsoid conidia (Pirozynski 1972); *D. hughesii* is separated by its subglobose oval to oblong smaller (7–12 × 5–7µm) conidia and highly branched longer conidiophores (Holubová-Jechová 1982, Wang & Sutton 1998), while *D. parcum* produces smaller (8.5–13 × 5.5–8 µm) ovate to obpyriform or ellipsoidal conidia (Holubová-Jechová 1982).

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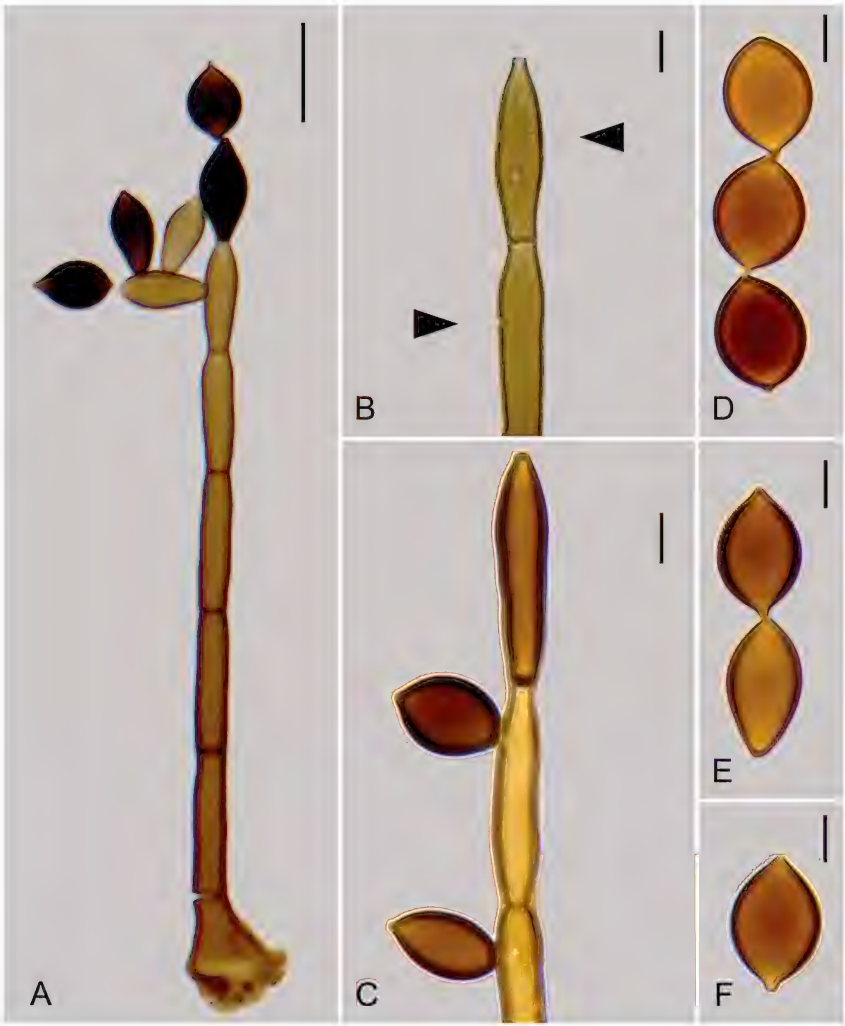

Fig 1. *Diplococcium variegatum* (ex HUEFS 194254). A. Conidiophore and conidia. B. Conidiogenous cell and pores (indicated by arrows). C. Conidiogenous cells and conidia. D–F. Conidia. Scale bars: A = 20 µm; B–F = 5 µm.

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Additions to *Ramularia* species (hyphomycetes) in Poland

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Abstract — The morphology and revised distribution of three *Ramularia* species (teleomorphs unknown) are presented based on fresh specimens. *Ramularia melampyri* is new for Poland, and *R. celastri* is reported from its third (and easternmost) locality in Europe. *Ramularia abscondita* specimens confirm the occurrence of this species in Poland. As *R. melampyri* hosts (*Melampyrum* spp.) are currently classified in *Orobanchaceae,* the implications of the new systematics of *Scrophulariaceae* s.l. for the taxonomy of *Ramularia* and related *Mycosphaerella* species are discussed briefly.

Key words — microfungi, asexual morphs, plant parasites, biogeography, new records

Introduction

The genus *Ramularia*, described by Unger in 1833 (cf. Braun 1998), is one of the largest anamorph genera, with known teleomorphs classified in the ascomycetous genus *Mycosphaerella* Johanson (Braun 1998, Crous 2009). *Mycosphaerella* s.l. is polyphyletic, but its type species, *M. punctiformis* (Pers.) Starbäck, has a proven *Ramularia* anamorph (*R. endophylla* Verkley & U. Braun). Consequently, the name *Mycosphaerella* s.str. has been confined to sexual morphs associated with *Ramularia* anamorphs (Verkley et al. 2004, Crous et al. 2009a). According to the new rules of Art. 59 of the ICN (McNeill et al. 2012), *Mycosphaerella* and *Ramularia* are heterotypic synonyms, and so the older name *Ramularia,* which has priority, is now a holomorph name.

Ramularia species have been assumed to form a single lineage within the *Mycosphaerellaceae*. The recently described *Mycosphaerella cerastiicola* Crous, which clusters in the middle of the *Ramularia* clade, has a septoria- or pseudocercosporella-like anamorph (Crous et al. 2011), which casts reasonable doubt on the monophyly of *Ramularia*. Unfortunately, *M. cerastiicola* has not been included in the recent studies of *Septoria* and septoria-like genera (Quaedvlieg et al. 2013, Verkley et al. 2013).

The genus has been the subject of thorough taxonomic studies worldwide (Braun 1998, Crous et al. 2001, 2009a, 2011; Braun & Pennycook 2003, Braun

et al. 2005, Zhang 2006, Kirschner 2009). The Polish monograph covered 115 *Ramularia* species (Wołczańska 2005). The number of taxa known in Poland was further extended with *Ramularia celastri* (Czerniawska 2007), *R. epilobiana* (Sacc. & Fautrey) B. Sutton & Piroz. (Ruszkiewicz-Michalska 2006), and *R. vallisumbrosae* Cavara (Wołczańska 2010). In addition, ecological data on two very rare species (*R. agrimoniae* Sacc. and *R. uredinearum* Hulea) have been reported in Poland (Ruszkiewicz-Michalska et al. 2012), and a new host plant (*Hypochoeris radicata* L.) has been listed for *R. inaequalis* (Preuss) U. Braun (Wołczańska & Wołkowycki 2010).

Materials & methods

Plant organs affected by *Ramularia* species were collected in 2007 and in 2012. *Ramularia melampyri* and *R. abscondita* were found during systematic studies of plant-parasitic fungi in the Las Łagiewnicki forest complex in the city of Łódź (central Poland). This forest complex is under strong anthropogenic pressure, as many residents use it for recreational purposes (Kurowski 2001). We found a single specimen of *R. celastri* in Biebrza National Park (NE Poland); this largest and among the newest Polish national parks is preserving the whole river valley with its natural longitudinal and transversal zonation of habitats and corresponding plant communities (Dyrcz & Werpachowski 2005) as well as numerous interesting and endangered fungi (Kujawa et al. 2012). Geographical coordinates were obtained with Garmin's GPSmap 60 device. Collector abbreviations include MRM = Ruszkiewicz-Michalska, EP = Połeć, and AK = Agnieszka Kuchnik.

Fresh specimens were mounted in lactophenol picric acid solution (Fluka) and examined using a Nikon Eclipse 50i microscope; measurements of morphological structures were made also in tap water. Microphotographs were taken with a Nikon DS-F1 digital camera using phase contrast.

The fungi were identified based on Braun's (1998) monograph, and their host plants were determined using the key by Rutkowski (2004). The fungal nomenclature agrees with Index Fungorum (2014) while the host nomenclature follows Mirek et al. (2002) and The International Plant Names Index (2014). The study material is deposited in the subcollection Parasitic Fungi (labeled as PF) of the Fungal collection of Herbarium Universitatis Lodziensis (LOD).

Our attempts to isolate and cultivate the three reported species failed despite using standard methods (Crous et al. 2009b, Verkley et al. 2004). Also, the enrichment of culture media (WA, MEA, CMA, OA, Difco) with autoclaved host leaves elicited no positive effect.

Species characteristics

Ramularia melampyri Ellis & Dearn., Canad. Record Sci. 5: 271 (1893) Pl. 1

Leaf spots very inconspicuous, diffuse discolorations, pale greenish, later brownish green. Conidiophores in small to fairly large, loose to dense, cream-colored fascicles, scattered at the leaf spot area, arising from stromata, straight,

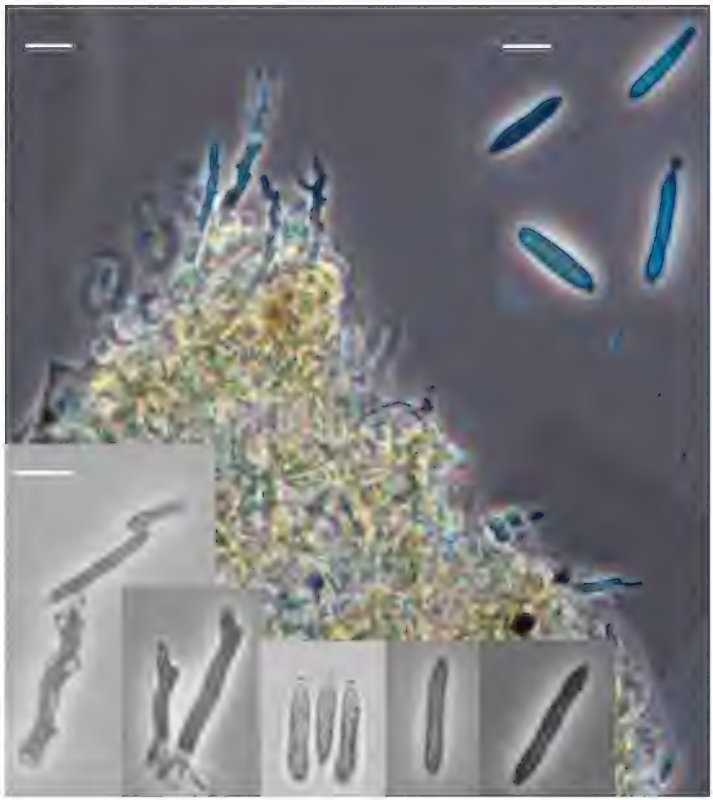

PLATE 1. *Ramularia melampyri* (LOD 3383): conidiophores and conidia (lactophenol picric acid solution; phase contrast). Scale bars = 10 µm.

subcylindric to flexuous, filiform, geniculate-sinuous, simple, 20–42.5 × 2–3.7 µm [5–100 × 2–6.5 µm; Braun 1998], continuous to septate, hyaline, smooth; conidial scars slightly thickened and darkened. CONIDIA catenate, ellipsoid-ovoid, subcylindric-fusiform, (8.5–)10–24.5 × 2.5–5 µm [(9–)12–28(–30) × (3–)4–6.5(–8) µm; Braun 1998], 0–1-septate, hyaline, smooth, ends obtuse to somewhat attenuated; hila somewhat thickened, darkened.

SPECIMENS EXAMINED — On *Melampyrum nemorosum* L.: **POLAND, ŁÓDŹ VOIVODESHIP**, Łódź, Las Łagiewnicki forest, roadside, 51°49′59″N 19°28′10″E, 28 July 2007, leg. MRM (LOD 3383); 08 Aug. 2012, leg. EP (LOD 3384).

ECOLOGY & DISTRIBUTION — This species has been recorded on eight *Melampyrum* species [*Orobanchaceae*] from North America and Eurasia (Braun 1998, Farr & Rossman 2014, Negrean & Denchev 2000, Pando et al. 2003, GBIF 2014a).

Ramularia melampyri has no known teleomorphic or synanamorphic connections (Tomilin 1979, Braun 1998, Aptroot 2006, Anon. 2014).

Comments — *Scrophulariaceae* s.l., which has undergone revision based mainly on molecular studies, has been split into four families (cf. Stevens 2014). Consequently, host-based keys to *Ramularia* species on *Scrophulariaceae* s.l., such as those by Braun (1998) and Wołczańska (2005), may need some reconstruction. A summary of the host-pathogen relationships of these *Ramularia* species, disposed under the four segregate host families, is presented in Fig. 1.

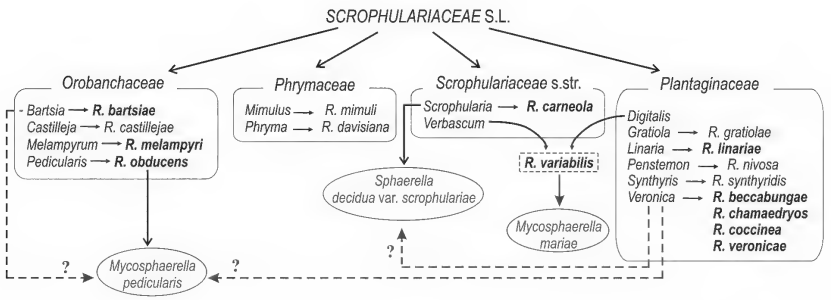

Figure 1. Host-parasite relationships in *Scrophulariaceae* s.l. (*Ramularia* species occurring in Poland set in bold font; teleomorphs are given within ellipses). Survey based on plant phylogeny updates (Stevens 2014) and on mycological data given by Braun (1998), Braun & Scheuer (2008), Tomilin (1979), Aptroot (2006), and Anon. (2014).

The difficulty with host-based taxonomy of *Ramularia* is most evident with *R. variabilis* Fuckel, originally described by Fuckel (1870) from both *Verbascum* [*Scrophulariaceae* s.str.] and *Digitalis* [*Plantaginaceae*], and subsequently lectotypified on *Verbascum* (Braun 1998). The *Mycosphaerella* names tentatively associated with *Ramularia* species on *Scrophulariaceae* s.l. also indicate a high degree of uncertainty (Fig. 1), involving hosts from more than one of the new segregate host families. The molecular relationships between *Ramularia*/*Mycosphaerella* species associated with *Scrophulariaceae* s.l. are largely unexplored. *Ramularia coccinea* (Fuckel) Vestergr. is the only taxon for which rDNA sequences have been deposited in GenBank (accessed 15 March 2014).

Ramularia abscondita (Fautrey & Lambotte) U. Braun, Int. J. Mycol. Lichenol. 3: 280 (1988) Pl. 2

Leaf spots angular-irregular, 1–10 mm diam., yellowish-ochraceous to light to medium brown, confluent, margin brown, narrow or indefinite.

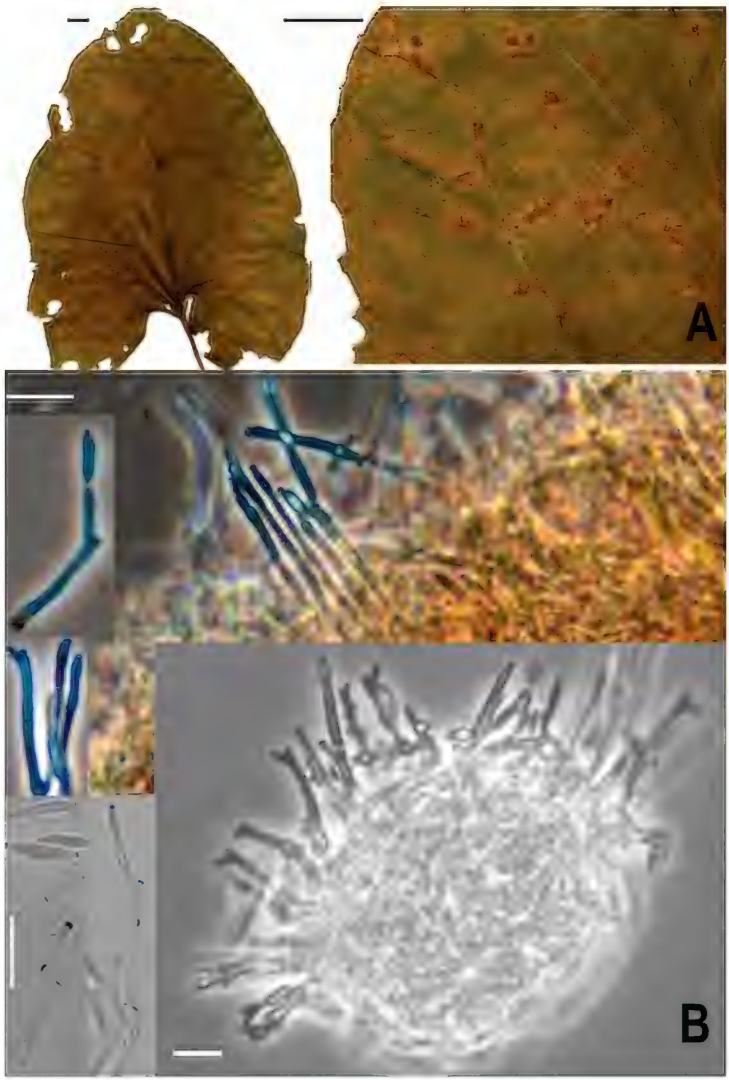

Plate 2. *Ramularia abscondita* (LOD 3218): A – a leaf of host plant with symptoms of fungal infection; B – conidiophores and conidia (lactophenol picric acid solution; phase contrast). Scale bars: A = 1 cm; B = 10 µm.

Conidiophores in small, loose fascicles, on the upper leaf surface, straight, subcylindric to geniculate-sinuous, mostly simple, (9.5–)11.25–25(–27) × 1.25–2.5 µm, septate, hyaline and smooth; conidial scars somewhat thickened and darkened. Conidia catenate, rarely in short, branched chains, ellipsoid,

subcylindric, (6.5–)7.5–17.5 × 2.5(–3) µm, aseptate, occasionally 1-septate, hyaline, smooth, ends obtuse to subacute; hila somewhat thickened, darkened.

Specimens examined — On *Arctium lappa* L.: **POLAND, Łódź Voivodeship**, Łódź, Las Łagiewnicki forest, roadside, 51°50′06″N 19°28′06″E, 28 July 2007, leg. MRM (LOD 3362); Gać Spalska nature reserve, forest road close to the Gać river, 51°34′31″N 20°08′01″E, 11 Aug. 2012, leg. MRM (LOD 3363).

On *Arctium nemorosum* Lej.: **POLAND, Łódź Voivodeship**, Łódź, Las Łagiewnicki forest, oak-hornbeam forest (*Tilio-Carpinetum calamagrostietosum*), roadside, 51°50′02″N 19°28′21″E, 28 July 2007, leg. AK (LOD 3218); 25 Aug. 2007 (LOD 3217).

On *Arctium tomentosum* Mill.: **POLAND, Łódź Voivodeship**, Łódź, Las Łagiewnicki forest, opening near Building of Forestry Unit, 51°50′26″N 19°28′18″E, 28 May 2012, leg. MRM (LOD 3450).

Ecology & distribution – This species has been reported on six *Arctium* species (*Asteraceae*) in Asia and Europe, including Poland (Braun 1998, Farr & Rossman 2014, GBIF 2014b). However, the Polish reports given by Braun (1998) were probably based on old records or collections and remain unclear and unproven (Braun, pers. comm.). *Ramularia abscondita* was not included in the Polish *Ramularia* monograph (Wołczańska 2005) or checklist of Polish micromycetes (Mułenko et al. 2008). We also have found no specimens or literature to confirm the previous Polish records.

Ramularia abscondita has no known teleomorphic or synanamorphic connections (Tomilin 1979, Braun 1998, Aptroot 2006, Anon. 2014).

Ramularia celastri Ellis & G. Martin, Amer. Naturalist 16: 1003 (1882) Pl. 3

= *Ramularia monachorum* Bubák, Bot. Közl. 14: 79 (1915)

Leaf spots subcircular to irregular, dark greenish, later greyish-ochraceous, margin narrow, reddish brown. Conidiophores hypophyllous, in small, loose to dense fascicles, arising from stromata, geniculate-sinuous, simple, (8.5–)10–45 × 1.5–3.5(–4) µm, continuous to 1-septate, hyaline, smooth; conidial scars slightly thickened and darkened. Conidia mostly catenate, subcylindric to fusiform, 9.5–30(–32) × 2.5–4.5 µm, 0–2-septate, hyaline, smooth, subobtuse; hila somewhat thickened, darkened.

Specimen examined — On *Euonymus europaea* L.: **POLAND, Podlaskie Voivodeship**, Biebrza National Park, Kapice protective unit, oak-hornbeam forest (*Tilio-Carpinetum*), 53°32′14″N 22°43′13″E, 28 Aug. 2012, leg. MRM (LOD 3451) [together with *Asteromella euonymella* (Sacc.) Aa & Vanev, *Septogloeum carthusianum* (Sacc.) Sacc.].

Ecology & distribution — This species has been reported mostly from North America and Asia (mainly China) on diverse *Celastrus* and *Euonymus* species (Braun 1998, Farr & Rossman 2014, GBIF 2014c, Cybertruffle's Robigalia 2014). In Europe it is known only from three collections on *E. europaea*: Bubák's holotype of *R. monachorum* from the Piva Monastery in northern Montenegro

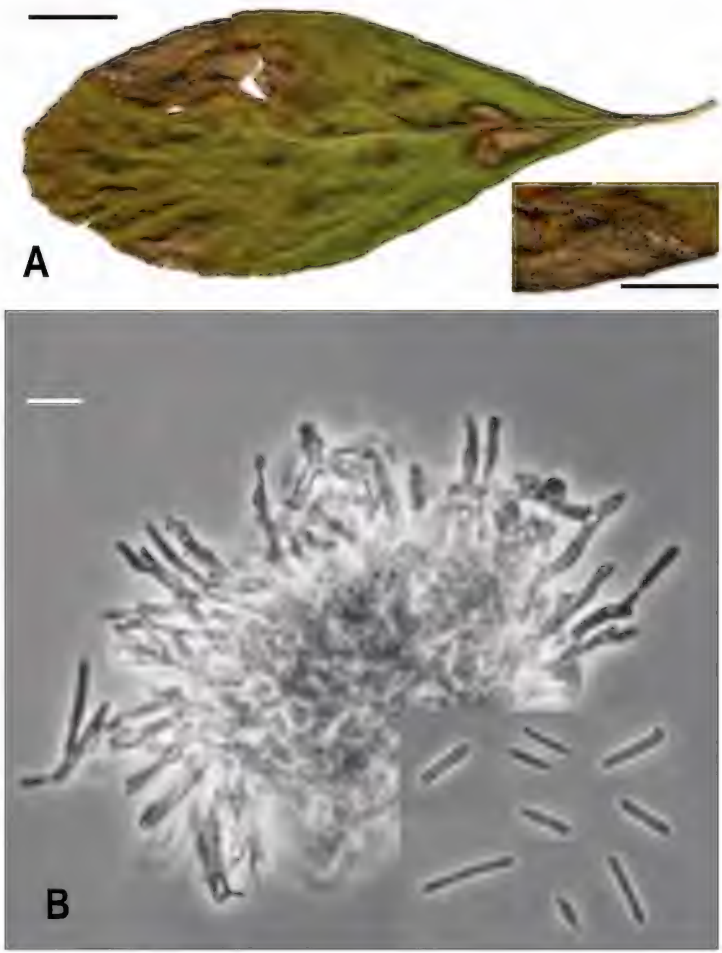

Plate 3. *Ramularia celastri* (LOD 3451): A – a leaf of host plant with symptoms of fungal infection; B – conidiophores and conidia (lactophenol picric acid solution; phase contrast). Scale bars: A = 1 cm; B = 10 μm.

(Farr & Rossman 2014); a report from Drawa National Park in northwestern Poland (Czerniawska 2007); and our new record, which extends the European range of this species to eastern Poland.

Ramularia celastri has no proven teleomorphic or synanamorphic connections (Tomilin 1979, Braun 1998, Aa & Vanev 2002, Aptroot 2006, Anon. 2014).

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The genus *Moreaua* in Japan and Korea

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Abstract — The *Moreaua* species, distributed in Japan and Korea, are presented. *Moreaua aterrima* is reported for the first time from both countries. *Carex callitrichos* var. *nana*, *C. mira*, and *C. tenuiformis* are new host records for this smut fungus.

Key words — *Anthracoideaceae*, *Cyperaceae*, *Moreaua mauritiana*, taxonomy, *Ustilaginomycetes*

Introduction

Moreaua Liou & H.C. Cheng was described as a monotypic genus typified by *M. kungii* on *Carex* sp. from China (Liou & Cheng 1949). The genus was proposed to accommodate a spore ball forming smut fungus with spore germination intermediate between the classical *Ustilago* and *Tilletia* forms. As originally illustrated (Liou & Cheng 1949: Pls 4–6), the germination produces phragmobasidia that bear terminally or laterally ovoid to ellipsoidal basidiospores, usually with terminal or subterminal basidiospore chains. Because subsequently, chains of basidiospores (cf. single basidiospore at the apex of each phragmobasidium cell) were considered insufficient for establishing a new genus, *M. kungii* was reduced to a synonym of *Thecaphora aterrima* (Wang 1963). The name *Moreaua* remained largely unused in the scientific literature until the 1990s (comp. Vánky 1987, 1994), up to which time *Thecaphora aterrima* was mostly recognized as *Tolyposporium aterrimum* (e.g., Lindeberg 1959, Vánky 1985, 1994, Karatygin & Azbukina 1989).

In the 1990s, it became apparent that *Tolyposporium* was a heterogeneous genus of spore ball forming species (Vánky 1994, 2000). *Thecaphora aterrima*, *T. apicis* Savile, and all spore ball forming species on *Cyperaceae* described in *Tolyposporium* or transferred from *Sorosporium* to *Tolyposporium* (excluding *T. neillii* (G. Cunn.) Vánky & McKenzie) were removed to the resurrected genus *Moreaua* (Vánky 2000, 2003). In addition, a number of new *Moreaua* species have been recently described (Vánky & Shivas 2001, Piepenbring 2001, Vánky

2002, 2009, Vánky et al. 2009, Shivas et al. 2011). Currently, *Moreaua* comprises 38 species, known mostly from the Southern Hemisphere (33 species), with only seven recorded from the Northern Hemisphere. All species are parasites on host plants in *Cyperaceae*.

Moreaua belongs to *Anthracoideaceae* Denchev. The sori are developed in flowers and form a naked, black, granular-powdery mass of spore balls on the surface of filaments and/or ovaria (in some species also filling aborted and deformed nuts) that are completely hidden by adjacent glumes. Columella, peridium, and sterile cells are lacking. Spore balls are composed of rather firmly cohering spores.

Until the beginning of this study, only one *Moreaua* species, *M. mauritiana,* was known from Japan, reported from the Bonin Islands as *Thecaphora fimbristylidis* (Harada 1979). Later, this record was included in the Kakishima's monograph of the smut fungi in Japan as *Thecaphora aterrima* (Kakishima 1982, see also Katumoto 2010). *Moreaua aterrima* is reported here for the first time from Japan. The current study is a part of an ongoing complete revision of the smut fungi on *Cyperaceae* in Japan (comp. Denchev et al. 2013).

There are no records of *Moreaua* from the Korean Peninsula (Denchev et al. 2007). The three specimens of *Moreaua aterrima* listed here for the first time from South Korea were found by one of us (C.M.D.) during examination of specimens in phanerogamic herbaria in Seoul.

Material & methods

This study is based on examination of specimens from the following dried reference collections: DAOM – National Mycological Herbarium, Agriculture and Agri-Food Canada; SNUA – T.B. Lee Herbarium, College of Agriculture and Life Sciences, Seoul National University, Seoul, S. Korea; SWU – Sungshin Women's University Herbarium, Seoul, S. Korea; and TSH – Laboratory of Plant Parasitic Mycology, Faculty of Life and Environmental Sciences, University of Tsukuba, Tsukuba, Japan.

For LM observations and measurements, spores were mounted in lactophenol solution on glass slides, gently heated to boiling point to rehydrate the spores, and then cooled. In order to count the number of spores in a spore ball and for observation of the spore morphology, the spore balls were bleached in concentrated hydrogen peroxide (H_2O_2) for 10–15 minutes. For SEM, spores were attached to specimen holders by double-sided adhesive tape and coated with gold with an ion sputter. The surface structure of spores was observed at 10 kV accelerating voltage and photographed with a JEOL JSM-5510 scanning electron microscope.

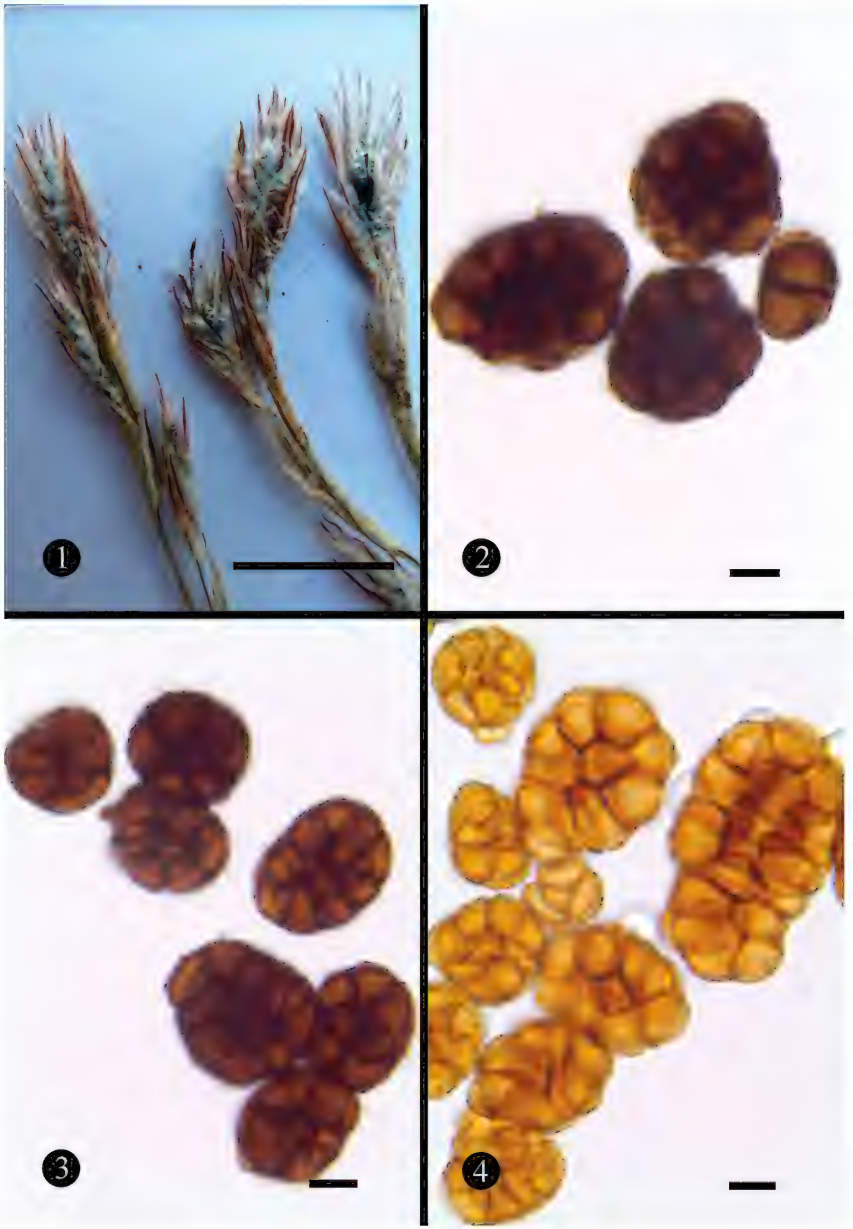
Taxonomy

Moreaua aterrima (Tul. & C. Tul.) Vánky, Mycotaxon 74: 351, 2000. Figs 1–4, 9, 10

≡ *Thecaphora aterrima* Tul. & C. Tul., Ann. Sci. Nat., Bot., Sér. 3, 7: 110, 1847.

≡ *Tolyposporium aterrimum* (Tul. & C. Tul.) Dietel, in Engler & Prantl, Nat. Pflanzenfam. 1(1**): 14, 1897.

= *Moreaua kungii* Liou & H.C. Cheng, Contr. Inst. Bot., Natl. Acad. Peiping 6: 210, 1949.



Figs 1–4. ***Moreaua aterrima*** on ***Carex callitrichos*** var. ***nana*** (SWU): 1. Habit; 2. Spore balls in LM. ***M. aterrima*** on ***Carex lanceolata*** (DAOM 38 528): 3. Spore balls in LM; 4. Spore balls bleached in hydrogen peroxide in LM. Scale bars: 1 = 1 cm; 2–4 = 10 μm.

Sori on filaments and the bases of scales of staminate flowers (spore balls concealed by the staminate scales) or on aborted ovaria (spore balls concealed by the utricles). The mass of spore balls very dark reddish-brown to black, granular-powdery. Infection systemic. Infected female flowers transformed into male flowers with sori. Spore balls globose, subglobose, ovoid, broadly ellipsoidal to slightly irregular, composed of 2–20(–35), firmly united spores, occasionally single spores present, 13.5–45(–56) × 12.5–35(–41) µm, dark reddish-brown or middle reddish-brown when composed of few spores. Spores in surface view broadly elliptical, subglobose, subpolyhedral or irregular, measured from the free side 9.5–17(–18.5) × 8.5–14.5 µm; radially 6.5–17 µm long (on *Carex mira* and *C. tenuiformis* spores in surface view sometimes up to 21 µm long, and radially sometimes up to 22 µm long); wall two-layered, endospore even, 0.6–1.2 µm thick, exospore uneven, 1.1–3.2 µm thick (on *C. mira* 1.0–2.3 µm), much thicker at the free surface than at the contact surfaces, the free surface rather coarsely ornamented as seen by LM & SEM,[1] flattened and smooth on the contact sides.

Specimens examined — On *Carex lanceolata* Boott: **JAPAN, Honshu, Tochigi Pref.**, Mt. Iwafune, 14 May 1950, leg. T. Koyama, det. D.B.O. Savile (as *Thecaphora aterrima*, DAOM 38 528).

On *Carex callitrichos* var. *nana* (H. Lév. & Vaniot) Ohwi (≡ *C. humilis* var. *nana* (H. Lév. & Vaniot) Ohwi; = *C. nanella* Ohwi): **SOUTH KOREA, Gangwon Prov.**, Mt. Samack, 20 Sep 2000, leg. Y.C. Oh, J.Y. Yun & J.K. Lee (SWU, sine num.).

On *Carex mira* Kük.: **SOUTH KOREA, Gangwon Prov.**, Jeongseon-gun, Imgye-myeon, 29 May 1993, leg. T.B. Lee (SNUA 76 476).

On *Carex tenuiformis* H. Lév. & Vaniot: **SOUTH KOREA**, sine loc., sine dat., leg. T.B. Lee (SNUA 51 750).

Distribution — *Moreaua aterrima* is reported from Europe, Asia (East Siberia, Far East of Russia, China, India), North America, and North Africa (Liou & Cheng 1949, Savile 1953, Azbukina et al. 1995, Guo 2000, Vánky 2011, Vánky et al. 2011). It was known to infect 21 species of *Carex*. In East Asia, it has been found only in Kamchatka on *Carex vanheurckii* Müll. Arg. (Azbukina et al. 1995), and in China on *Carex lanceolata* (Guo & Xi 1989, Guo 2000) and *Carex* sp. (Liou & Cheng 1949). *Moreaua aterrima* is reported here for the first time from Japan and the Korean Peninsula. *Carex callitrichos* var. *nana*, *C. mira*, and *C. tenuiformis* are new host records for this smut fungus.

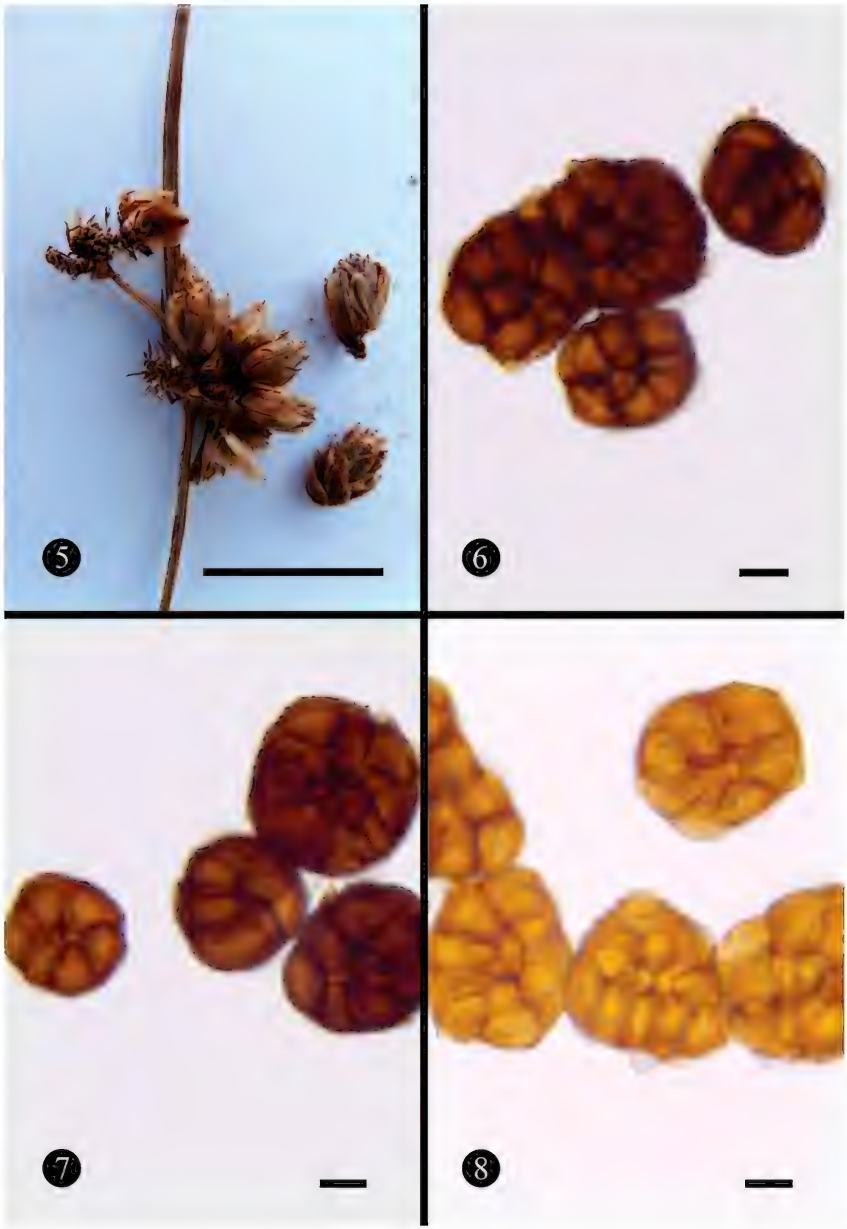
Moreaua mauritiana (Syd.) Vánky, *Mycotaxon* 74: 352, 2000. Figs 5–8, 11, 12

≡ *Tolyposporium mauritianum* Syd., Ann. Mycol. 37: 201, 1939.

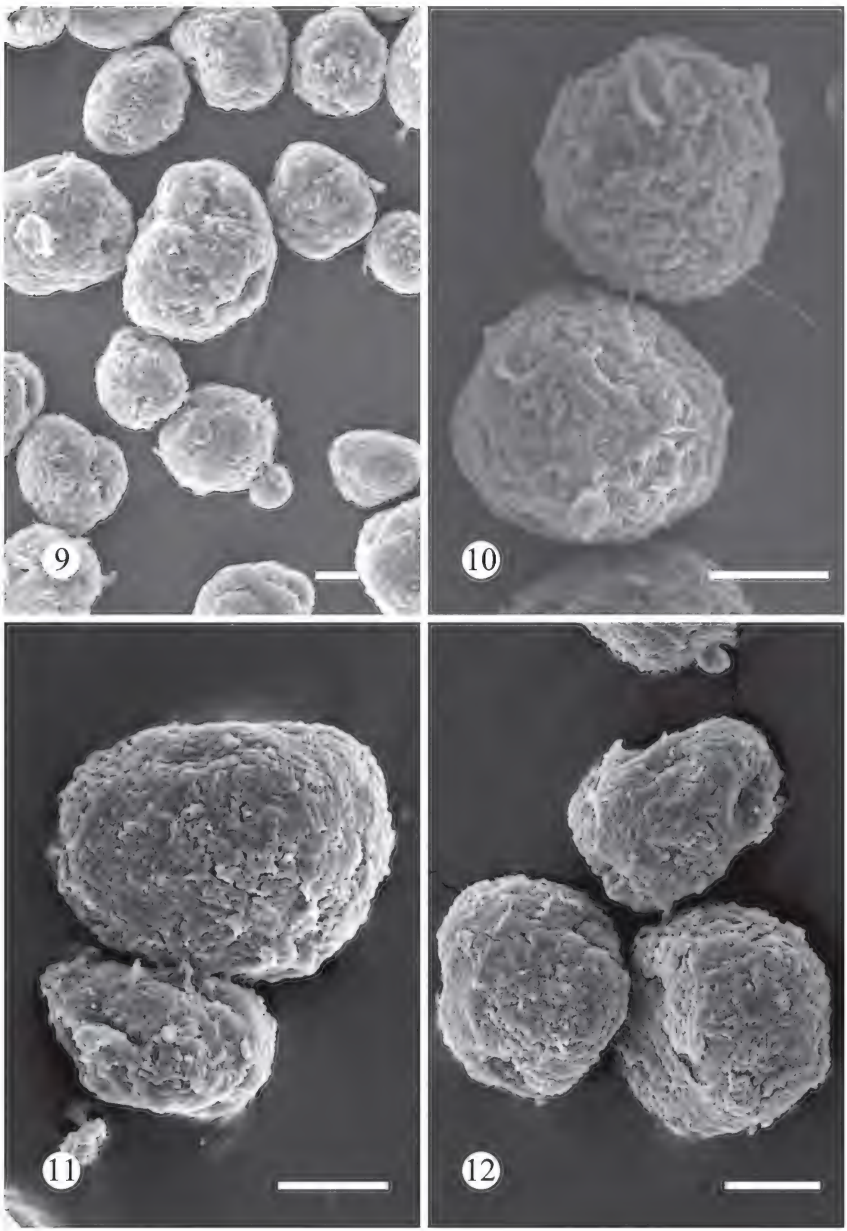
≡ *Thecaphora mauritiana* (Syd.) L. Ling, Sydowia 4: 80, 1950.

= *Thecaphora fimbristylidis* Mundk. & Thirum., Mycol. Pap. 16: 4, 1946.

[1] The irregular spore ornamentation of former *Tolyposporium* spp. on *Cyperaceae* was interpreted by Piepenbring et al. (1998: 193) as 'material of adjacent remnants of hyphae and sheaths deposited onto and into the exosporium.'



Figs 5–8. ***Moreaua mauritiana*** on ***Fimbristylis longispica*** var. ***hahajimensis*** (TSH S340): 5. Habit; 6–7. Spore balls in LM; 8. Spore balls bleached in hydrogen peroxide in LM. Scale bars: 5 = 1 cm; 6–8 = 10 μm.



Figs 9–12. ***Moreaua aterrima*** on ***Carex callitrichos*** var. ***nana*** (SWU): 9. Spore balls in SEM. ***M. aterrima*** on ***Carex lanceolata*** (DAOM 38 528): 10. Spore balls in SEM. ***M. mauritiana*** on ***Fimbristylis longispica*** var. ***hahajimensis*** (TSH S340): 11–12. Spore balls in SEM. Scale bars = 10 μm.

Sori around anthers and rudimentary ovaries; in the anthers spore balls replace the pollen grains and anther wall. The mass of spore balls dark reddish-brown, granular-powdery, concealed by the adjacent glumes and outwardly inconspicuous. Infection systemic; all flowers sterile. Spore balls persistent, globose, subglobose, broadly ellipsoidal or irregular, composed of 2–17(–23), firmly united spores, 17–45(–54) × 16–38(–45) µm, sometimes single spores present; dark reddish-brown. Spores in surface view subglobose, subpolyhedral or irregular, radially semi-globose, subcuneiform or irregular; measured from the free side (10.5–)12–18.5(–20) × (9–)10–15(–15.5) µm, radially (6–)7–17(–18.5) µm long; wall two-layered, endospore even, 0.8–1.3 µm thick, exospore uneven, 1.2–3.4 µm thick, much thicker at the free surface than at the contact surfaces, the free surface rather coarsely ornamented as seen by LM & SEM,[2] flattened and smooth on the contact sides.

Specimen examined — On *Fimbristylis longispica* var. *hahajimensis* (Tuyama) Ohwi: **JAPAN, Ogasawara Archipelago (Bonin Islands),** Haha-jima, Oki-mura, 4 Dec 1977, Y. Harada, no. 171 (as *Thecaphora fimbristylidis,* TSH S340).

Distribution — This smut fungus is reported from Africa (Mauritius, Reunion, South Africa), Asia (Japan, India), and Hawaii and is known to infect four species of *Fimbristylis: F. cymosa* subsp. *umbellatocapitata* (Hillebr.) T. Koyama (= *F. cymosa* var. *pycnocephala* (Hillebr.) Kiik.), *F. longispica* var. *hahajimensis, F. ovata* (Burm. f.) J. Kern (= *F. monostachya* (L.) Hassk.), and *Fimbristylis* sp. (Mundkur & Thirumalachar 1946, Mäkinen 1969, Harada 1979, Vánky 2011, Vánky et al. 2011).

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We gratefully acknowledge Dr Kálmán Vánky (Herbarium *Ustilaginales* Vánky, Tübingen, Germany) and Dr Roger G. Shivas (Biosecurity Queensland, Australia) for critically reading the manuscript and serving as pre-submission reviewers, and Directors and Curators of DAOM, SNUA, SWU, and TSH for loans of the cited specimens and/or permission to visit their reference collections. Cvetomir M. Denchev thanks Prof. H.D. Shin (Korea University, Seoul) for the assistance during his stay in South Korea in 2006.

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[2] See previous footnote on page 76.

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New species of microfungi from Brazilian Amazon rainforests

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Abstract —*Isthmophragmospora laevispora* sp. nov., *Henicospora amazonensis* sp. nov., and *Sporidesmiella curtiphora* sp. nov. found on submerged decaying plant materials are described and illustrated. *Isthmophragmospora laevispora* is distinguished by smooth pale brown conidia, each composed of two unequal 2-septate bodies connected by a cellular isthmus; *H. amazonensis* is characterized by clavate to pyriform, 3–4-septate, 1–2 distoseptate, smooth, pale golden brown conidia; and *S. curtiphora* has obovoid to lamp-shaped, 1-septate, olivaceous-brown conidia.

Key words — asexual fungi, freshwater fungi, taxonomy

Introduction

The diversity of anamorphic fungi in the Brazilian Amazon has received little attention, especially in freshwater habitats. During a survey of hyphomycetes associated with plant litter submerged in black water streams from Manaus (Amazonas, Brazil), three undescribed species of the genera *Isthmophragmospora*, *Henicospora*, and *Sporidesmiella* were collected. These specimens, which cannot be assigned to any species currently accepted in these genera, are described herein as new to science.

Materials & methods

Samples of submerged litter were placed in paper and plastic bags. In the laboratory the samples were placed in Petri dish moist chambers and stored in a 170 L polystyrene

Fig. 1. *Isthmophragmospora laevispora* (holotype HUEFS 194256).
A–F. Conidia. G–I. Conidiophores and conidiogenous cells. J. Conidiogenous cell and conidia.
Scale bars = 10 μm.

box with 200 mL sterile water plus 2 mL glycerol, at 25°C for 30 days (Castañeda-Ruiz 2005). Mounts were prepared in PVL (polyvinyl alcohol, lactic acid, and phenol) and measurements were made at a magnification of ×1000. Micrographs were obtained with an Olympus microscope (model BX51) equipped with bright field and Nomarski interference optics. The type specimens are deposited in the Herbarium of Universidade Estadual de Feira de Santana (HUEFS).

Taxonomy

Isthmophragmospora laevispora J.S. Monteiro, Gusmão & R.F. Castañeda, **sp. nov.** Fig. 1

MycoBank MB805115

Differs from *Isthmophragmospora verruculosa* by its smooth pale brown conidia with 2-septate distal bodies.

Type: Brazil, Amazonas State: Reserva Florestal Adolpho Ducke, 2°55′S 59°58′W, on submerged decaying leaves in a black water stream, 13.March.2013; coll. B.M.P. Ottoni (**Holotype**: HUEFS 194256).

Etymology: Latin, *laevispora,* refers to smooth conidia.

Colonies scattered, effuse, pale brown. Mycelium mostly immersed in substrate. Conidiophores macronematous, mononematous, erect, straight to slightly flexuous, simple, 6–10-septate, smooth, brown, 60–90 × 5–6 µm. Conidiogenous cells polyblastic, integrated, cylindrical, sympodially elongated, denticulate, pale brown, 15–37 × 3–4 µm. Conidial secession schizolytic. Conidia solitary, phragmosporous, smooth, pale brown, 28–51 µm long; two conidial bodies of unequal lengths connected by a narrow isthmus, 1 µm long; proximal conidial body clavate, 2-euseptate, 13–23 µm long, 3–5 µm wide near the isthmus, tapering gradually towards to the point of attachment, 1.5–2 µm wide; distal conidial body obclavate, 2-euseptate, 15–30 µm long, 3.5–5 µm wide near the isthmus, tapering gradually to 1.5–2 µm wide at the rounded apex.

Note: The monotypic genus *Isthmophragmospora* was introduced by Kuthubutheen & Nawawi (1992) for *I. verruculosa* Kuthub. & Nawawi, isolated from submerged decaying twigs in Malaysia. The type species differs from *I. laevispora* by its longer verruculose conidium with a 4–5-septate distal body (Kuthubutheen & Nawawi 1992).

Henicospora amazonensis J.S. Monteiro, Gusmão & R.F. Castañeda, **sp. nov.** Fig. 2

MycoBank MB805116

Differs from *Henicospora coronata* by its wider obovoid to pyriform pale golden brown conidia with prominent apical projections.

Type: Brazil. Amazonas State: Reserva Florestal Adolpho Ducke, 2°56′S 59°57′W, on submerged decaying leaves in a black water stream, 13. March.2013; coll. B.M.P. Ottoni (**Holotype**: HUEFS 194257).

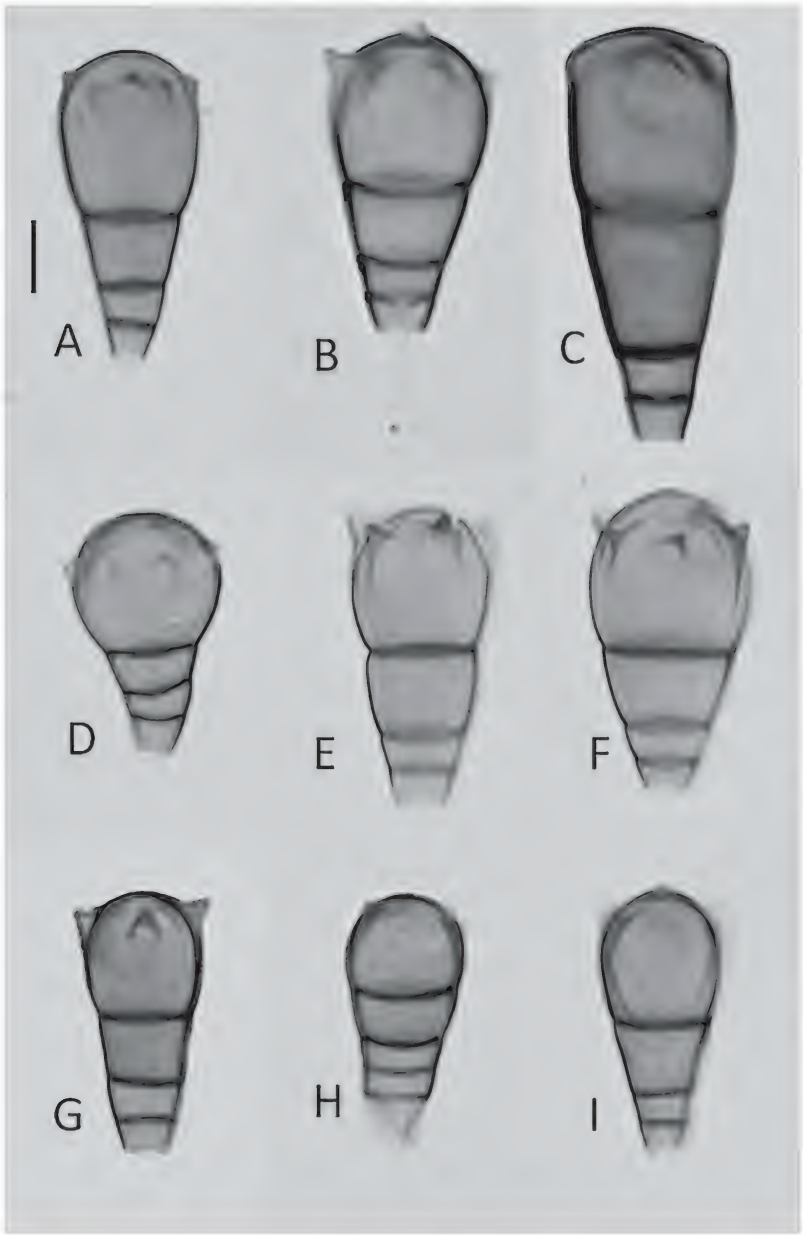

Fig. 2. *Henicospora amazonensis* (holotype HUEFS 194257). A–I. Conidia. Scale bar = 5 µm.

Etymology: Latin, *amazonensis*, referred to the locality of the type specimen.

Colonies effuse, often inconspicuous hairy, pale brown. Mycelium superficial and immersed in substrate. Conidiophores micronematous, mononematous, erect, straight to slightly flexuous, simple, smooth, hyaline, mostly reduced to conidiogenous cells. Conidiogenous cells monoblastic, integrated, terminal, smooth, hyaline, 7.5–12.5 × 2.5 µm. Conidial secession rhexolytic. Conidia clavate to pyriform, 3–4-septate, 1–2 distoseptate, smooth, pale golden brown, 18.5–27.5 × 8–12.5 µm; truncated base, 4–5 µm wide; coronate at apex with 4–6 conical projections, 2–3 × 1–2 µm.

Note: *Henicospora* was erected by Kirk & Sutton (1980) with *H. minor* P.M. Kirk & B. Sutton (type) and two other species; two other species were subsequently added (Kuthubutheen & Nawawi 1994, Matsushima 1989). *Henicospora coronata* P.M. Kirk & B. Sutton somewhat resembles *H. amazonensis* but differs by its cylindrical pale olivaceous brown 5-distoseptate conidia that are 20–29 × 4–5 µm and have inconspicuous mammiform coronal projections (Kirk & Sutton 1980).

Sporidesmiella curtiphora L.T. Carmo, Gusmão & R.F. Castañeda, **sp. nov.** Fig. 3

MycoBank MB805117

Differs from *Sporidesmiella pachyanthicola* by its much shorter conidiophores and larger obovoid to lamp-shaped conidia.

Type: Brazil. Amazonas State: Reserva Florestal Adolpho Ducke, 2°55′S 59°58′W, on submerged decaying leaves in a black water stream, 13.March.2013; coll. B.M.P. Ottoni (**Holotype**: HUEFS 196427).

Etymology: Latin, *curtiphora*, refers to very small conidiophores.

Colonies scattered, effuse, hairy, light brown. Mycelium superficial and immersed in substrate. Conidiophores macronematous, mononematous, solitary, erect, straight, simple, cylindrical, 0–1-septate, smooth, brown, (17.5–) 22.5–25 × 2.5 µm, sometimes reduced to conidiogenous cells. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, with 3–7 enteroblastic percurrent elongations, pale brown. Conidial secession schizolytic. Conidia solitary, obovoid to lamp-shaped, 1-septate, smooth, olivaceous brown, cell lumina reduced, 20–22 × 10 µm; truncate at the base, 3 µm wide.

Note: *Sporidesmiella* was introduced by Kirk (1982) with *S. claviformis* P.M. Kirk (type) and five other species and one variety. Subsequently 25 additional taxa have been introduced (Ma et al. 2011, Santa Izabel & Gusmão 2013). *Sporidesmiella curtiphora* is similar only to *S. pachyanthicola* W.B. Kendr. & R.F. Castañeda (Castañeda-Ruiz & Kendrick 1991), which is clearly differentiated

Fig. 3. *Sporidesmiella curtiphora* (holotype HUEFS 196427).
A–D. Conidiophores, conidiogenous cells and conidia. E–F. Conidia. Scale bars = 10 µm.

by its longer (75–200 × 4–7.5 µm) conidiophores and smaller (10–14.5 × 3–4.5 µm) clavate guttulate conidia.

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Cristinia tubulicystidiata sp. nov. from India

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Abstract — A new corticioid species, *Cristinia tubulicystidiata*, is described from the Kalatop area, Chamba (Himachal Pradesh), India.

Key words — *Agaricomycetes,* tubular cystidia, Dalhousie, Lakkar Mandi

While conducting fungal forays in the Kalatop area near Dalhousie in district Chamba, Himachal Pradesh (India), Dhingra and Hallenberg collected an unknown corticioid fungus on a fallen tree of *Cedrus deodara*. On the basis of cyanophilous basidiospores and granules in the basidia, the specimen was compared with species within *Cristinia* (Parmasto 1968, Liberta 1973, Eriksson & Ryvarden 1975, Nakasone & Gilbertson 1978, Baici & Hjortstam 1984, Hjortstam et al. 1987, Hjortstam & Grosse-Brauckmann 1993, Bernicchia & Gorjón 2010, Nakasone 2008, 2012) but could not be assigned to any known species. We describe it here as a new species and provide a key to all species of *Cristinia*.

Cristinia tubulicystidiata J. Kaur, Dhingra & Hallenberg, **sp. nov.** Figs 1–6

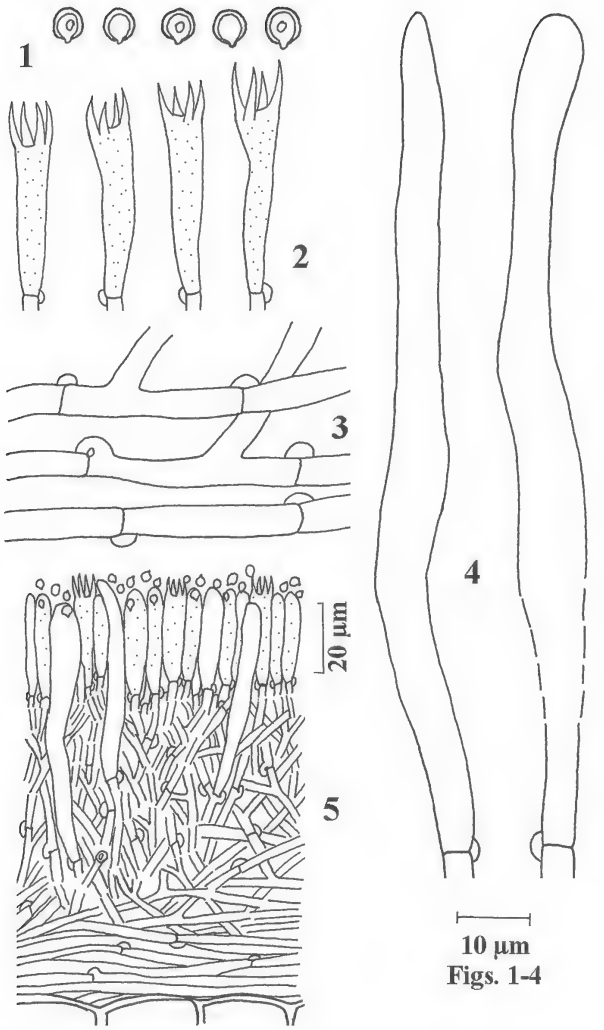
MycoBank 801273

Differs from all other *Cristinia* species by its tubular smooth embedded cystidia.

Type: India, Himachal Pradesh: Chamba, Dalhousie, about 2 km from Lakkar Mandi towards Kalatop, on log of *Cedrus deodara* (Roxb. ex D. Don) G. Don, 16 August 2010, Dhingra & Hallenberg 4763 (PUN, **holotype**).

Etymology: The epithet refers to the presence of tubular cystidia.

Basidiocarp resupinate, adnate, effused, ceraceous, up to 150 µm thick in section; hymenial surface smooth, cream-coloured to pale orange; margins thinning out, concolorous and indeterminate. Hyphal system monomitic; generative



Figs 1–5. *Cristinia tubulicystidiata* (holotype, PUN).
1. Basidiospores; 2. basidia; 3. generative hyphae; 4. cystidia; 5. section through basidiocarp.

hyphae 3–4.5 µm wide, septate, clamped; basal hyphae parallel to the substrate, forming a distinct subicular layer, approximately 25 µm thick, hyphae sparsely branched but densely united, with distinct walls and big clamps; subhymenial hyphae vertical, thin-walled, more branched. Cystidia 106–145 × 7.7–8.3 µm,

FIG. 6. *Cristinia tubulicystidiata* (holotype, PUN). Basidiocarp showing hymenial surface.

tubular but with slightly irregular outline, smooth, with distinct walls and a light refracting content in phase contrast, arising from the basal hyphae and do not project above the hymenial level. Basidia 19–25 × 4.4–5.5 µm, cylindrical but somewhat constricted, with basal clamp, 4-sterigmate; sterigmata ≤6.1 µm long. Blue-stained granules are found in the basidia when stained in Cotton Blue. Basidiospores 3.3–4.5 × 3.5–5.0 µm, subglobose to globose, some spores slightly angular in outline, with a distinct oil-drop, smooth, with thickened walls, distinctly cyanophilous and metachromatic in phase, inamyloid.

REMARKS— The staining of spore walls in cotton blue and basidial granules are characteristic of *Cristinia*. *Cristinia tubulicystidiata* is easily recognized by its smooth ceraceous basidiome and the tubular smooth embedded cystidia that distinguish it from all other species in the genus.

Key to the species of *Cristinia*

We follow the generic concepts of Hjortstam & Grosse-Brauckmann (1993) and Nakasone (2008, 2012).

1. All hyphae without clamps 2
1. Hyphae with clamps, at least on subhymenial hyphae 3
2. Hymenophore grandinoid, basal hyphae 4–6 µm wide ..... *C. artheniensis*
2. Hymenophore smooth to minutely grandinioid, basal hyphae 8–10 µm wide ..... *C. brevicellularis*

3. Basal hyphae without or with scattered clamps, subhymenial hyphae with clamps 4
3. All hyphae with clamps 5
4. Hymenium stained violet with KOH, spores 5–7 µm in diam. ..... *C. rhenana*
4. Hymenium not stained violet with KOH, spores 4–5 µm in diam. ..... *C. coprophila*
5. Hymenial surface aculeate or irpicoid 6
5. Hymenial surface smooth to hypochnoid to grandinoid 7
6. Spores broadly ellipsoid, 3.6–4.5 × 2.9–3.5 µm ..... *C. decolorans*
6. Spores subglobose, 5–6 µm in diam. ..... *C. eichleri* (= *C. gallica*)
7. Cystidia present ..... *C. tubulicystidiata*
7. Cystidia absent ..... *C. helvetica*

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Phallus coronatus sp. nov. from Vietnam

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Abstract — *Phallus coronatus*, a new small lignicolous gasteroid fungus, is described and compared with related species.
Key words — gasteromycetes, *Phallales*, taxonomy

Introduction

Phallus Junius ex L. is a widespread (mostly in tropics and subtropics) easy distinguished genus. Calonge (2005) cited 25 species of *Phallus* s.l., while Kreisel (1996) listed approximately 31 species with 19 indusiate taxa (Kreisel & Hausknecht 2009). Recently, several additional species have been described (Li et al. 2005, Calonge et al. 2008, Desjardin & Perry 2009, Moreno et al. 2009), so that by 2012, about 35 species (excluding doubtful taxa) were referred to the genus.

Mycologists from Moscow State University and Komarov Botanical Institute of Russian Academy of Sciences (RAS) have been investigating mycobiota diversity in Vietnam since 2010 under the auspices of the Research Program of the Vietnam-Russian Tropical Research and Technological Centre (VRTC; for details see Morozova et al. 2012). As a result, one new gasteroid species, *Calvatia holothurioides* Rebriev, has been described (Rebriev 2013). In this paper, we describe a new small lignicolous *Phallus* species.

Materials & methods

The material was collected during the March 29–April 14, 2012, expedition of VRTC in Chu Yang Sin National Park (Krong Bong District, Dak Lak Province). The Park, located 45 km southeast of Buon Ma Thuot Town, is one of the most important national

parks of Vietnam and represents a transitional forest between the lowland plain and Central Highlands. With Bi Doup–Nui Ba National Park with which it is contiguous, it forms the largest forest complex in Vietnam. The dominant vegetation type is broadleaf evergreen forest with emergent conifer along the ridgelines.

Basidiomes were dried using silica gel and packed in plastic bags (grippers). The type material is deposited in the mycological herbarium of the V.L. Komarov Botanical Institute of RAS (LE). Microstructures were studied under a light microscope Micmed-6 using 5% KOH solution. Scanning electronic microphotographs (SEM) were taken using a Carl Zeiss EVO-40 XVP in the South Science Center of Russian Academy of Sciences. Microscopic measurements were made with the specialized software Scandium 5.0. The collection was photographed in the field by A.V. Alexandrova, but without description. So all measurements were made from dried material.

Taxonomy

Phallus coronatus Rebriev, **sp. nov.** PLATE 1

MycoBank MB 804357

Differs from *Phallus drewesii* by its larger basidiomes, its pinkish pileus with a conspicuous apical disc, and its thicker pseudostipe reticulation ridges.

TYPE: Vietnam, Dak Lak Province, Krong Bong District, Chu Yang Sin National Park, Krong Kmar, 1.5 km W of Chu Pan Phan mountain 12°22.57′N 108°20.53′E, 1377 m a.s.l., on a fallen unidentified tree trunk in a polydominant montane forest with *Fagaceae, Magnoliaceae, Theaceae, Podocarpaceae*, 10 Apr. 2012. coll. A.V. Alexandrova (**Holotype**, LE 295238).

ETYMOLOGY: *coronatus*, refers to conspicuous disc with flattered margins on the top of pileus.

UNEXPANDED FRUITBODY (egg stage) ovoid, 10–14 × 8--10 mm, brownish gray to dark brown, covered with unicolored scales and cracked; mycelial cords thin, white, branched. MATURE BASIDIOMES 40–70 mm high. Pseudostipe ≤4 mm in diam., gradually narrowing upward, white, deeply reticulate-lacunose with ellipsoid reticulations 2–3 × 0.5–1.5 mm. Indusium absent. Pileus receptacle 9–15 mm high and 3-6 mm in diam., conical-truncate, reticulate, pinkish; meshes polygonal, roundish to longitudinally extended, (0.7–)1 (–1.5) mm wide; apex truncated, formed by a plane, depressed, perforated, disc-like surface. GLEBA olivaceous, foetid. VOLVA with surface features and pigmentation identical to the egg stage. SPORES 3.5–4.0 × 1.5–2.0 μm, ellipsoid, smooth, subhyaline.

ECOLOGY: Gregarious, lignicolous on fallen trees.

Discussion

There are several *Phallus* species with small basidiomes, white pseudostipe when fresh, brownish exoperidium, and lignicolous habit.

Phallus drewesii Desjardin & B.A. Perry, which is the morphologically most similar species to *P. coronatus,* produces smaller basidiomes, a white pileus

Plate 1. *Phallus coronatus* (holotype, LE 295238): a. Fruitbodies; b. Unexpanded fruitbodies (eggs); c. Basidiospores.

with a less conspicuous apical disc, and thinner ridges on the pseudostipe reticulation (Desjardin & Perry 2009). *Phallus minusculus* Kreisel & Calonge forms smaller basidiomes with a spongy (not reticulate) pseudostipe (Calonge & Kreisel 2002). *Phallus pygmaeus* Baseia produces smaller basidiomes with a smooth pileus (Baseia et al 2003). *Phallus tenuis* (E. Fisch.) Kuntze differs in forming larger basidiomes with a yellow pileus and yellow pseudostipe that is spongy and not reticulate (Calonge 2005). *Phallus calongei* G. Moreno & Khalid, which is also characterized by a pileus topped by a conspicuous

disc, produces much larger basidiomes with spongy pseudostipes and is non-lignicolous (Moreno et al. 2009).

The infrageneric position of *P. coronatus* is not known. Based on its reticulated perforated pileus, the new species could be referred to subgenus *Phallus* (Kreisel 1996), close to section *Phallus*. However, its colored volva would exclude *P. coronatus* from section *Phallus*. Molecular data could clarify this problem.

The preliminary checklist of Vietnamese fungi (Trinh 1998) lists 50 gasteromycetous species from Vietnam, including four other *Phallus* species: *P. aurantiacus* Mont., *P. indusiatus* Vent., *P. multicolor* (Berk. & Broome) Cooke, and *P. rubicundus* (Bosc) Fr.

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We express deepest gratitude to Prof. H. Kreisel, Prof. F.D. Calonge, and Dr. D.E. Desjardin for valuable advice. We thank Dr. K.V. Dvadnenko for preparing the SEM photographs. The authors are grateful to director Tong Ngoc Chung and the administration of the Chu Yang Sin National Park for providing the opportunity to carry out the surveys in the Park. Our field studies in Vietnam were made possible due to the support of the Joint Vietnam-Russian Tropical Research and Technological Centre. We would like to express our thanks to Dr. A.N. Kuznetsov, Dr. Nguyen Dang Khoi, and all expedition members for their great help during the fieldwork.

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Distocercospora indica, a new dematiaceous hyphomycete from central India

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Abstract — The anamorphic fungus *Distocercospora indica* sp. nov., found on *Holoptelea integrifolia* (*Ulmaceae*), in East Forest Division, Chhindwara, Madhya Pradesh, India, is described, illustrated, and discussed.

Key words — biodiversity, foliar disease, cercosporoid fungus, taxonomic novelty

Introduction

Distocercospora N. Pons & B. Sutton, a genus of cercosporoid dematiaceous hyphomycetes (anamorphic fungi), was established by Pons & Sutton (1988) with *D. pachyderma* (Syd. & P. Syd.) N. Pons & B. Sutton (≡ *Cercospora pachyderma* Syd. & P. Syd.) on *Dioscorea alata* as type species. The slightly thickened darkened conidiogenous loci and pigmented conidia of *Distocercospora* resemble those in *Passalora,* from which *Distocercospora* differs in producing conidia that are consistently distoseptate. Before phylogenetic data were available, little significance was placed on distoseptation within the cercosporoid complex (Crous & Braun 2003). However, recent molecular sequence analyses of material of the type species (*D. pachyderma*) support *Distocercospora* as a separate genus phylogenetically distinct from *Passalora* (unpublished, U. Braun, in litt.).

Distocercospora is characterized by conidia that are solitary or (rarely) in short chains, distoseptate, subhyaline to pale brown, with thickened darkened hila, and schizolytic secession (Pons & Sutton 1988).

In addition to the new fungus described below, *Distocercospora* contains three species: *D. africana* Crous & U. Braun, *D. livistonae* U. Braun & C.F. Hill and *D. pachyderma* (Braun et al. 2006; Crous & Braun 1994; Pons & Sutton 1988).

Materials & methods

Living leaves with disease were collected during field trips. Detailed observations of morphological characters were carried out by means of a light microscope using oil immersion (1000×). Specimens for microscopic observations were prepared by hand sectioning. Water and lactophenol cotton blue were used as mounting media. Measurements were made of 30 conidia, hila and conidiophores and of 15 stromata. Line drawings were prepared at a magnification of 1000×. The holotype is deposited in Herbarium Cryptogamiae Indiae Orientalis (HCIO); Indian Agricultural Research Institute, New Delhi, India and the isotype in the collections of Naveen Verma Rai (NVR); Herbarium, Department of Botany, Dr. Harisingh Gour Central University, Sagar, Madhya Pradesh, India).

Taxonomy

Distocercospora indica N. Verma & A.N. Rai, **sp. nov.** FIGS 1, 2

MYCOBANK MB 804806

Differs from other *Distocercospora* species by its much longer conidiophores and by conidia that are sometimes catenate and constricted at the septa.

TYPE: India, Madhya Pradesh, Chhindwara, East Forest Division, on living leaves of *Holoptelea integrifolia* (Roxb.) Planch. (*Ulmaceae*), Feb. 2009, coll. Naveen Kumar Verma, (**holotype** HCIO 51096; **isotype** NVR 84).

ETYMOLOGY: Latin, *indica* refers to the country of origin.

Infection spots amphigenous, circular to irregular. Colonies hypophyllous, effuse, velvety, black. Mycelium internal; hyphae branched, septate, smooth, brown to dark brown, 3–5µm thick. Stromata well-developed, superficial, pseudoparenchymatous, brown to blackish brown, 30–160µm diam. Conidiophores macronematous, densely fasciculate, erect to procumbent, straight to flexuous, cylindrical, geniculate, simple to rarely branched at the apex, pluriseptate, thick-walled, brown to dark brown, light brown at the apex, 80–1000 × 4–6 µm. Conidiogenous cells integrated, terminal or intercalary, monoblastic or polyblastic, sympodial, denticulate (<4 µm high), scars conspicuously thickened and darkened, 1–1.5 µm wide. Conidia solitary to catenate, dry, acropleurogenous, simple, smooth, typically sickle-shaped, rarely straight, 0–5-distoseptate, sometimes constricted at the septa, thin-walled, smooth, fragile, obclavate to obclavate-cylindrical, apex obtuse, base obconically truncate, light brown to olivaceous-brown, 25–90 × 4–5 µm, hilum projecting, thickened and darkened, basal thickening ring-like, 1–1.5 µm wide.

REMARKS — No *Distocercospora* species has been reported on *Holoptelea* or any other ulmaceous host. *Distocercospora africana* and *D. pachyderma* were reported on *Dioscorea* spp. (*Dioscoreaceae*) and *D. livistonae* on *Livistona chinensis* (*Arecaceae*).

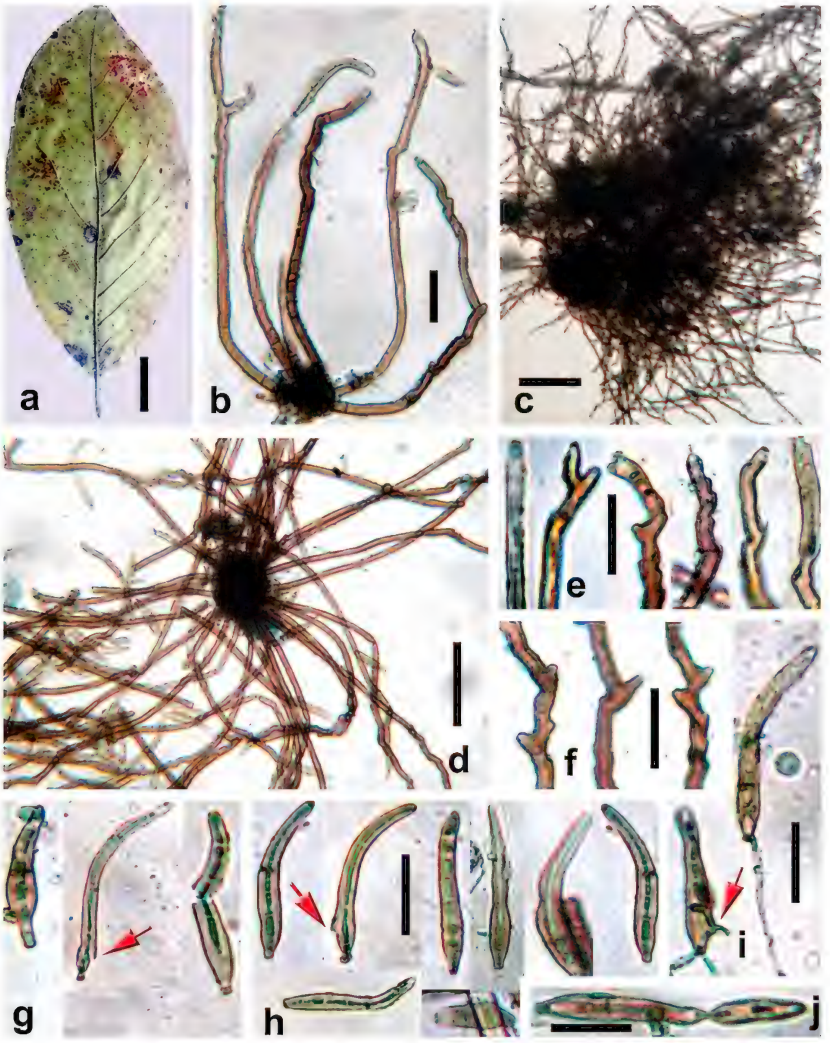

FIG. 1. *Distocercospora indica* (holotype).a. Symptoms; b. stroma, conidiophores, and conidium; c–d. well developed stroma; e. tip of conidiophores; f. intercalary conidiogenous cells; g. conidia with projected hilum; h. conidia; i. germinating conidia; j. catenate conidia. Scale bars: a = 1 cm; b, e–j = 20 µm; c = 100 µm; d = 40 µm.

Conidiophores of *D. indica* are much longer than in *D. africana* (15–80 × 3–10 µm), *D. livistonae* (40–280 × 3–6 µm) and *D. pachyderma* (75–600 × 3.5–6

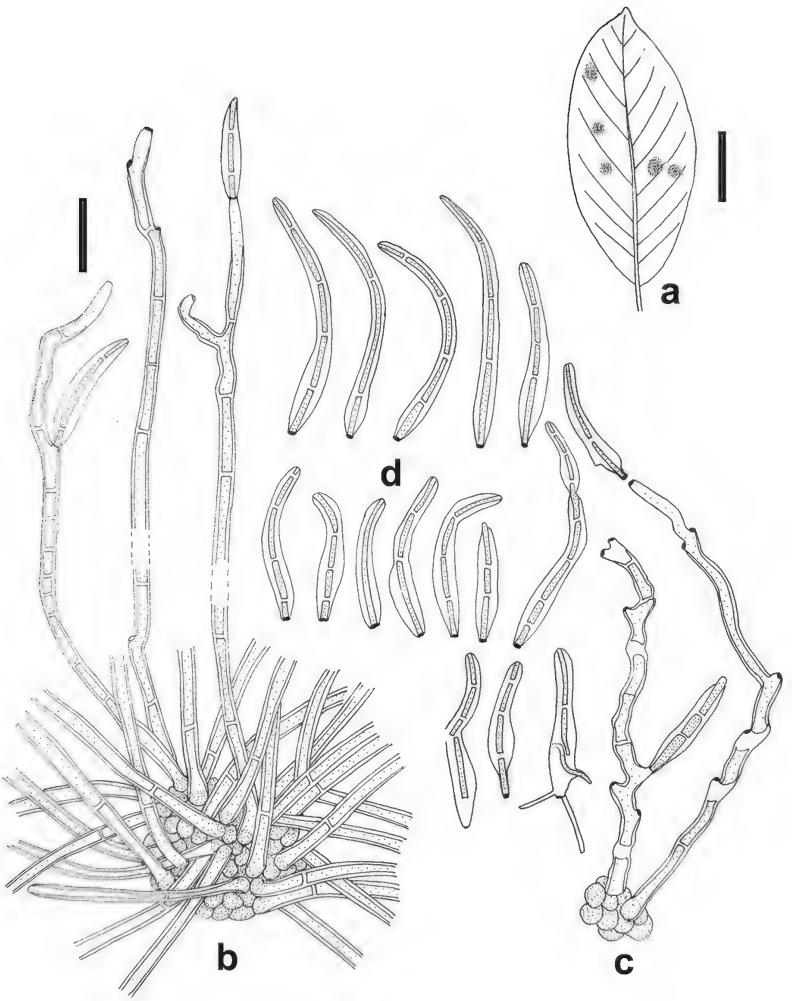

Fig. 2. *Distocercospora indica* (holotype).
a. Symptoms; b–c: stroma, conidiophores, and conidia; d. conidia.
Scale bars: a = 1 cm; b–d = 20 μm.

μm). Conidia of *D. indica* are somewhat shorter than in *D. africana* (30–110 × 3–5 μm) and somewhat narrower than in *D. pachyderma* (30–100 × 4.5–7 μm). Conidia of *D. indica* and *D. livistonae* (20–85 × 4–7 μm) are similar in size,

but those of *D. livistonae* are non-catenate and lack constrictions at the septa and a projecting hilum. A few conidia of *D. indica* also show a small pointed protuberance towards the proximal end (indicated by arrows in Fig. 1) that facilitates conidial germination.

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Mensularia lithocarpi sp. nov. from Yunnan Province, southwestern China

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Abstract — *Mensularia lithocarpi* is described and illustrated from Yunnan Province, southwestern China. Both morphological and phylogenetic evidence indicates the new species belongs to *Mensularia*. It is distinguished from two quite similar species, *Mensularia nodulosa* and *M. hastifera*, by the combination of lack of hymenial setae, presence of hyphoid setae, smaller basidiospores, and growth on *Lithocarpus chintungensis* in southwestern China.

Key words — *Hymenochaetaceae, Hymenochaetales,* polypore, taxonomy

Introduction

Mensularia Lázaro Ibiza is one of four genera segregated from *Inonotus* P. Karst. sensu lato (Dai 2010: 264). This genus is typified by the *Boletus radiatus* Sowerby (≡ *Mensularia radiata* (Sowerby) Lázaro Ibiza; Ryvarden 1991). *Mensularia* differs from *Inonotus* sensu stricto and the other three segregate genera (*Inocutis* Fiasson & Niemelä, *Inonotopsis* Parmasto, and *Onnia* P. Karst.) by its strongly cyanophilous basidiospores (Dai 2010). It is also characterized by annual basidiocarps on angiosperms, a monomitic hyphal system, and presence of hymenial setae (Ghobad-Nejhad & Kotiranta 2008). Wagner & Fischer (2001), who confirmed *Mensularia* as an independent genus through their nuclear large subunit rDNA (nLSU)-based phylogeny, added two species, *M. hastifera* (Pouzar) T. Wagner & M. Fisch. and *M. nodulosa* (Fr.) T. Wagner & M. Fisch. Later, *M. crocitincta* (Berk. & M.A. Curtis) T. Wagner & M. Fisch. was included in *Mensularia* based on morphological characters, in contradiction to the phylogenetic evidence (Wagner & Fischer 2002). Currently, these four species are accepted in this phylogenetically heterogeneous genus.

In China, only one *Mensularia* species, *M. radiata,* was previously recorded (Dai 2012), although many new species belonging to poroid *Hymenochaetaceae*

have been originally described (Dai & Cui 2005, Cui & Dai 2008, Dai et al. 2008, Cui et al. 2009, Zhou & Jia 2010, Zhou & Dai 2012, Zhou & Qin 2012, 2013, Zhou & Xue 2012, Cui & Decock 2013, Zhou 2013, 2014). During repeated field surveys for polypores in 2013, an unknown specimen was collected in Yunnan Province, southwestern China. This specimen, which is both morphologically and phylogenetically supported as a new *Mensularia* species, is described and illustrated here. An identification key to worldwide species of *Mensularia* adapted from Ghobad-Nejhad & Kotiranta (2008) is provided.

Materials & methods

The studied specimens were deposited at the herbaria of Institute of Applied Ecology, Chinese Academy of Sciences, Shenyang, P.R. China (IFP), Institute of Microbiology, Beijing Forestry University, Beijing, P.R. China (BJFC), and Botanical Museum, Finnish Museum of Natural History, Helsinki, Finland (H). The microscopic procedure follows Zhou (2013). The following abbreviations are used: L = mean basidiospore length (arithmetic average of all basidiospores), W = mean basidiospore width (arithmetic average of all basidiospores), Q = the L/W ratio, and n = number of basidiospores measured/number of specimens measured. Sections prepared in Melzer's reagent, Cotton Blue and 5% potassium hydroxide were studied using a Nikon Eclipse 80i microscope at magnification ×1000. When presenting the variation in basidiospore size, the upper and lower 5% of measurements are excluded from the range and the extreme values are presented in parentheses. Line drawings were made with the aid of a light tube. Special color terms follow Petersen (1996).

Phire® Plant Direct PCR Kit (Finnzymes Oy, Finland) was used to amplify nLSU from herbarium specimen Dai 13235 with primers LR0R and LR7 (Vilgalys & Hester 1990). The PCR product was sequenced with same primers. The newly generated sequence was deposited at GenBank (http://www.ncbi.nlm.nih.gov/genbank). Other nLSU sequences (Figure 1) from species of *Inonotus* sensu lato were downloaded from GenBank for phylogenetic analysis. The nLSU from *Phellinus igniarius* (L.) Quél. was also downloaded as outgroup according to Wagner & Fischer (2001). The dataset was aligned using ClustalX 2.0 (Larkin et al. 2007) with default parameters. The neighbor-

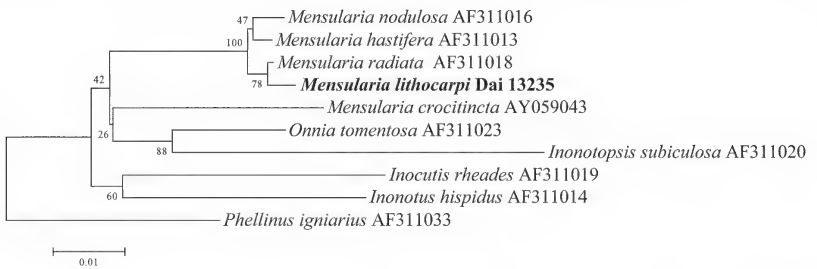

Figure 1. Neighbor-joining tree from nLSU sequences, indicating the phylogenetic position of the *Mensularia lithocarpi* holotype (Dai 13235).

joining (NJ) tree was constructed using MEGA 5 (Tamura et al. 2011) based on Maximum Composite Likelihood of nucleotide model and complete deletion of gaps/missing data with 1,000 bootstrap replicates.

Taxonomy

Mensularia lithocarpi L.W. Zhou, **sp. nov.** FIGURES 2, 3

MYCOBANK MB 808395

Differs from *Mensularia nodulosa* by its lack of hymenial setae, its hyphoid setae, and its smaller basidiospores.

TYPE: China. Yunnan Province, Pu'er, Jingdong County, Ailaoshan Nature Reserve, on rotten wood of *Lithocarpus chintungensis* Y.C. Hsu & H.J. Qian (*Fagaceae*), 13.VII.2013, Dai 13235 (**holotype**, BJFC; **isotype**, IFP; GenBank KF684968).

ETYMOLOGY: *lithocarpi* (Lat.): refers to the host genus.

BASIDIOCARPS annual, resupinate to nodulose-pileate on the effused part, inseparable, without odor or taste when fresh, up to 5.2 cm in longest dimension, 3 cm wide. PILEI projecting up to 2 mm, 7 mm wide, and 3 mm thick at base. PILEAL SURFACE glabrous, straw-yellow; MARGIN obtuse, honey-yellow. PORE SURFACE straw-yellow to honey-yellow; STERILE MARGIN distinct, first straw-yellow, later honey-yellow, up to 5 mm wide; PORES angular, 4–6

FIGURE 2. *Mensularia lithocarpi* (holotype). Basidiocarps.

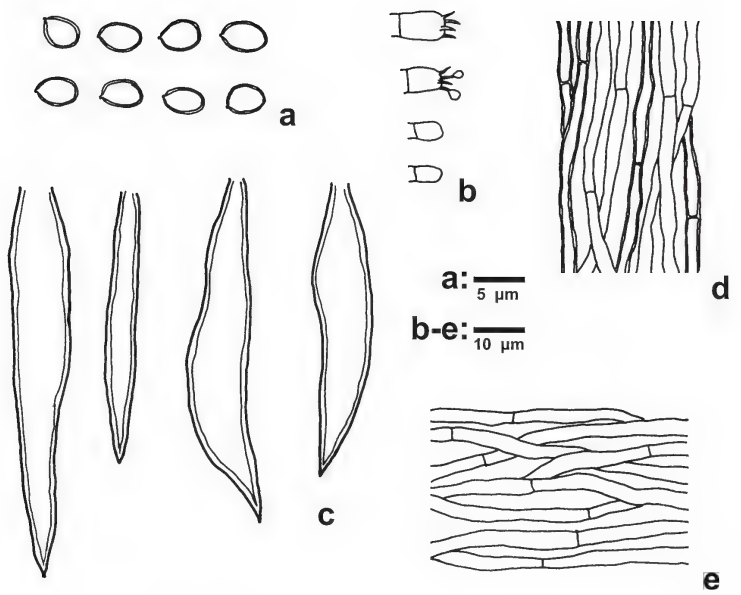

FIGURE 3. *Mensularia lithocarpi* (holotype). a: Basidiospores. b: Basidia and basidioles. c: Hyphoid setae. d: Hyphae from trama. e: Hyphae from subiculum.

per mm; DISSEPIMENTS thin, entire to occasionally lacerate. SUBICULUM straw-yellow, corky, up to 0.5 mm thick. TUBES concolorous with subiculum, corky, up to 5 mm long on oblique part.

HYPHAL SYSTEM monomitic; GENERATIVE HYPHAE simple septate; tissue becoming reddish brown but otherwise unchanged in 5% potassium hydroxide. CONTEXTUAL HYPHAE hyaline to pale yellowish, thin-walled with a wide lumen, unbranched, frequently simple septate, straight, regularly arranged, 2–4 µm in diam.; TRAMAL HYPHAE hyaline to yellowish, thin- to slightly thick-walled with a wide lumen, unbranched, frequently simple septate, straight, subparallel along the tubes, 3–4.5 µm in diam. HYMENIAL SETAE absent; HYPHOID SETAE prominent, brown to dark brown, thick-walled with a wide lumen, sometimes penetrating into hymenium, up to several hundred µm long and 15 µm in diam. in the widest part, apex sharp-pointed; CYSTIDIA and CYSTIDIOLES absent. BASIDIA barrel-shaped, hyaline, thin-walled, with four sterigmata and a simple septum at the base, 7–11 × 4–7 µm; BASIDIOLES similar to basidia in shape, but slightly smaller. BASIDIOSPORES ellipsoid, hyaline, slightly thick-walled, smooth, inamyloid and non-dextrinoid, strongly cyanophilous, (3.8–)3.9–4.6(–4.9) × (2.8–)2.9–3.5(–3.7) µm, L = 4.19 µm, W = 3.19 µm, Q = 1.31 (n = 30/1).

Other specimen examined: *Mensularia nodulosa*. **POLAND, Województwo krakowskie**, Ojcowski Park Narodowy, on fallen trunk of *Fagus sylvatica,* 19.IX.1978 Tuomo Niemelä 1353 (H; duplicate, IFP).

Remarks: *Mensularia lithocarpi* has annual basidiocarps, a monomitic hyphal system, and strongly cyanophilous basidiospores, which are the diagnostic morphological characters of *Mensularia*. In the NJ tree (Figure 1) from an alignment with 864 sites of 10 taxa, *M. lithocarpi* clustered with *M. hastifera, M. nodulosa,* and *M. radiata* with strong support (100%), indicating the new species belongs to *Mensularia.* Ghobad-Nejhad & Kotiranta (2008) treated ventricose hymenial setae as a shared character of *Mensularia*. Because *M. lithocarpi* has abundant hyphoid setae and no hymenial setae, it would be better to consider the presence of setae (either hymenial or hyphoid) as the stable character of *Mensularia.*

Macroscopically, *M. lithocarpi* is quite similar to *M. nodulosa* by sharing annual and resupinate to nodulose-pileate basidiocarps. However, *M. nodulosa* has larger basidiocarps (4.5–5 × 3.5–4 μm), lacks hyphoid setae, and bears hymenial setae (Ryvarden 2005). *Mensularia hastifera* has hyphoid setae, but it differs from *M. lithocarpi* in the entirely resupinate basidiocarps, longer basidiospores (4.5–5.2 × 3–4 μm), and presence of hymenial setae (Ryvarden 2005).

In addition, *M. hastifera* and *M. nodulosa* grow primarily on *Fagus sylvatica* in Europe and eastward to the Caucasus and Turkey (Ryvarden 2005), while the type specimen of *M. lithocarpi* inhabits *Lithocarpus chintungensis* in southwestern China.

World key to species of *Mensularia*

1a. Pores 7–9 per mm, known only from the Caribbean ..... *M. crocitincta*
1b. Pores <7 per mm, known from other parts of the world than the Caribbean 2
2a. Basidiocarps distinctly pileate ..... *M. radiata*
2b. Basidiocarps resupinate or nodulose-pileate 3
3a. Growth mainly on *Fagus sylvatica;* hymenial setae present, basidiospores mostly >4.5 μm long 4
3b. Growth on *Lithocarpus chintungensis;* hymenial setae absent, basidiospores mostly <4.5 μm long ..... *M. lithocarpi*
4a. Basidiocarps entirely resupinate; both hymenial and hyphoid setae present ..... *M. hastifera*
4b. Basidiocarps resupinate to nodulose-pileate; hymenial setae present, hyphoid setae absent ..... *M. nodulosa*

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Radulodon acaciae sp. nov. from India

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Abstract — A new corticioid species, *Radulodon acaciae* is described, associated with trees of *Acacia nilotica* from Chandigarh (India).

Key words — *Agaricomycetes, Basidiomycota,* bark, odontioid

While conducting fungal forays in Chandigarh (India), Gurpreet and G.S. Dhingra made a few collections of resupinate, odontioid fungi associated with trees of *Acacia nilotica*. After comparison of macroscopic and microscopic features (Rattan 1977, Eriksson et al. 1981, Stalpers 1998, Nakasone 2001, Bernicchia & Gorjón 2010), the collections have been identified as a species of *Radulodon* based on their hydnoid monomitic basidiocarps, slightly thick-walled, clamped hyphae, and broadly ellipsoid basidiospores. The new fungus is described here as *R. acaciae,* a species close to *R. erikssonii*. A portion of the basidiocarp was sent to Prof. Nils Hallenberg (Denmark), who confirmed the findings.

Radulodon acaciae G. Kaur, Avneet P. Singh & Dhingra **sp. nov.** Figs 1–6

MycoBank MB 805641

Differs from *Radulodon erikssonii* by its brownish orange to brownish grey hymenial surface, its brownish tramal hyphae, its smaller, broadly ellipsoid to subglobose basidiospores, and its tropical South Asian distribution on *Acacia* (*Leguminosae*).

Type: India, Union Territory, Chandigarh, Sector-18-D park, on bark of tree of *Acacia nilotica* (L.) Delile, 1 September 2012, G.S. Dhingra 5982 (PUN, **holotype**).

Etymology: The epithet refers to the substrate genus.

Basidiocarps resupinate, adnate, effused, ≤996 µm thick in section, hymenial surface hydnoid with dense spines ≤3mm long, cylindrical and tapering to aggregated and flattened; brownish orange to brownish red to violet brown when fresh, becoming dark grayish on drying; margins wavy, very thin and

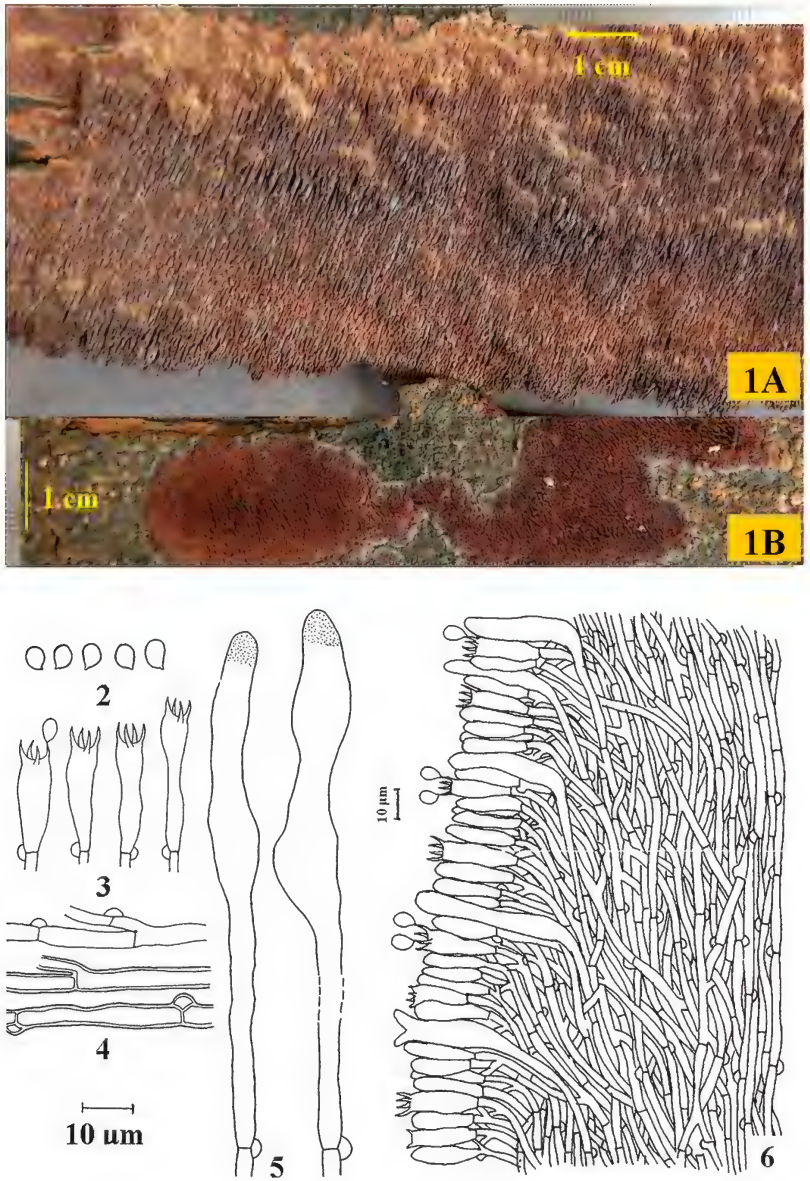

Plate 1. *Radulodon acaciae* (holotype). 1A. Mature basidiocarp showing hydnoid hymenial surface; 1B. Younger basidiocarp showing margins; 2. Basidiospores; 3. Basidia; 4. Hyphae; 5. Cystidia; 6 Vertical section through a portion of spine showing tramal hyphae, basidia, cystidia, and basidiospores.

greyish in young basidiocarps; thinning, paler concolorous, to indeterminate in mature basidiocarps. Hyphal system monomitic; generative hyphae ≤3.2 µm wide, branched, septate, clamped; basal hyphae intertwined and parallel to the substrate, tramal hyphae running more or less parallel, with thickened, light brownish walls; subhymenial hyphae compactly arranged, thin-walled. Cystidia 39–121 × 8.2–13.5 µm, clavate, thin- to slightly thick-walled, with resinous encrustation at the tip, originating in the trama and subhymenium but hardly projecting . Basidia 19.0–30.0 × 5.2–6.5 µm, clavate, 4-sterigmate, with basal clamp; sterigmata ≤3.0 µm long. Basidiospores 4.5–5.8 × 3.5–4.2 µm, broadly ellipsoid to subglobose, with thickened walls, inamyloid, acyanophilous.

Additional specimens examined: **INDIA**, **Union Territory**, Chandigarh, back side of Sukhna Lake, on bark of *Acacia nilotica*, 17 August 2013, Gurpreet 5983 (PUN); forest at the back side of Rock Garden, on bark of *A. nilotica*, 16 August 2013, Gurpreet 5984 (PUN).

Remarks — *Radulodon acaciae* is similar to *R. erikssonii* Ryvarden, which differs in its yellowish to pale buff hymenial surface, its hyaline tramal hyphae, its larger (6–8 × 5–6 µm) globose to subglobose basidiospores, and its temperate to subarctic Scandinavian distribution on *Populus* (*Salicaceae*) (Erikkson et al. 1981).

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Microfungi from Costa Rica. A new species and a new combination in *Codinaea*

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Abstract — *Codinaea delicata* sp. nov., a new microfungus (hyphomycete) collected on decaying leaves of an unidentified plant, is described and illustrated. It is distinguished by synnematous determinate conidiomata and monophialidic and polyphialidic conidiogenous cells that produce subreniform unicellular hyaline conidia with a single unbranched setula at each end. *Codinaea dendroidea* comb. nov. is proposed, and a key to synnematous *Codinaea* species is provided.

Key words — asexual fungi, systematics, leaf litter

Introduction

Maire (1937) erected *Codinaea* for the type species, *C. aristata*. He characterized the genus by distinct single brown to pale brown conidiophores that form a more or less fasciculate circle around a dark brown thick-walled septate seta. The conidiogenous cells were mono- or polyphialidic, terminal, determinate or with a few sympodial extensions and with distinct funnel-shaped flaring sometimes collapsed collarettes at the conidiogenous loci and producing unicellular or septate falcate to lunate hyaline conidia with a filiform appendage at each end. Hughes & Kendrick (1968), who added twelve species and expanded the generic concept by including species without setae and with synnematous conidiomata, considered the conidium ontogeny "phialidic" and conidiogenous cells with distinct funnel-shaped collarettes as primary generic characters. Gamundi et al. (1977), who examined several specimens

of *Dictyochaeta fuegiana* Speg. (the type species) collected on dead leaves of *Nothofagus dombeyi* (Mirb.) Oerst., considered *Dictyochaeta* (Spegazzini 1923) an earlier name for *Codinaea* (Maire 1937). The two genera share a phialidic conidium ontogeny with funnel-shaped flaring collarettes at the conidiogenous loci and erect straight septate brown setae accompanying the conidiophores. However, in *Dictyochaeta fuegiana* the conidia are cylindrical, curved, unicellular, and hyaline and lack appendages. Molecular evidence provided by Réblová & Winka (2000), were commented upon and accepted by Seifert et al. (2011) and Li et al. (2012), who supported segregation of *Codinaea* and *Dictyochaeta*. Li et al. (2012) recommended that species with filiform appendages be retained in *Codinaea* while taxa lacking appendages be placed in *Dictyochaeta*.

During a 2012 fungal conservation workshop at the University of Costa Rica, more than 250 samples of dead plant material colonized by microfungi were collected in several forests of Cartago Province, Costa Rica. Among these samples was a conspicuous synnematous fungus, an apparently undescribed *Codinaea* species, which we describe and illustrate here.

Materials & methods

Individual collections were placed in paper and plastic bags taken to the laboratory and treated according to Castañeda (2005). Mounts were prepared in polyvinyl alcohol-glycerol (8 g PVA in 100 ml of water, plus 5 ml of glycerol) and measurements made at a magnification of ×1000. Micrographs were obtained with a Zeiss Axioskop 40 microscope (Germany).

Taxonomy

Codinaea delicata R.F. Castañeda, Granados & O. Castro, **sp. nov.** Figs 1, 2

MycoBank MB801378

Differs from other synnematous *Codinaea* species by the smaller size and different shape of its conidia (sublunate to subreniform).

Type Costa Rica, Cartago Province, Orosi, Rio Macho, 9°45N 83°51′W, on decaying leaves of unidentified plant, 12 July 2012, coll. M. Granados, V. Vargas, G. Arroyo & I. Castro (**Holotype**: USJ 83283).

Etymology: Latin, *delicata*, means delicate, dainty, pretty.

Conidiomata on the natural substrate synnematous, scattered, determinate, 200–250 µm tall, 20–25 µm wide at the base, dark brown below and brown toward the apex, amphigenous. Mycelium superficial and immersed, composed of septate, branched, brown, smooth-walled hyphae 1–3 µm diam. Conidiophores distinct, erect, septate, closely packed in the synnematal stipe, slightly divergent toward the apex, 3–4 µm diam, brown to dark brown, smooth. Conidiogenous cells mono-and polyphialidic, integrated, 17–25 × 3–3.5 µm, mostly determinate, but sometimes indeterminate with

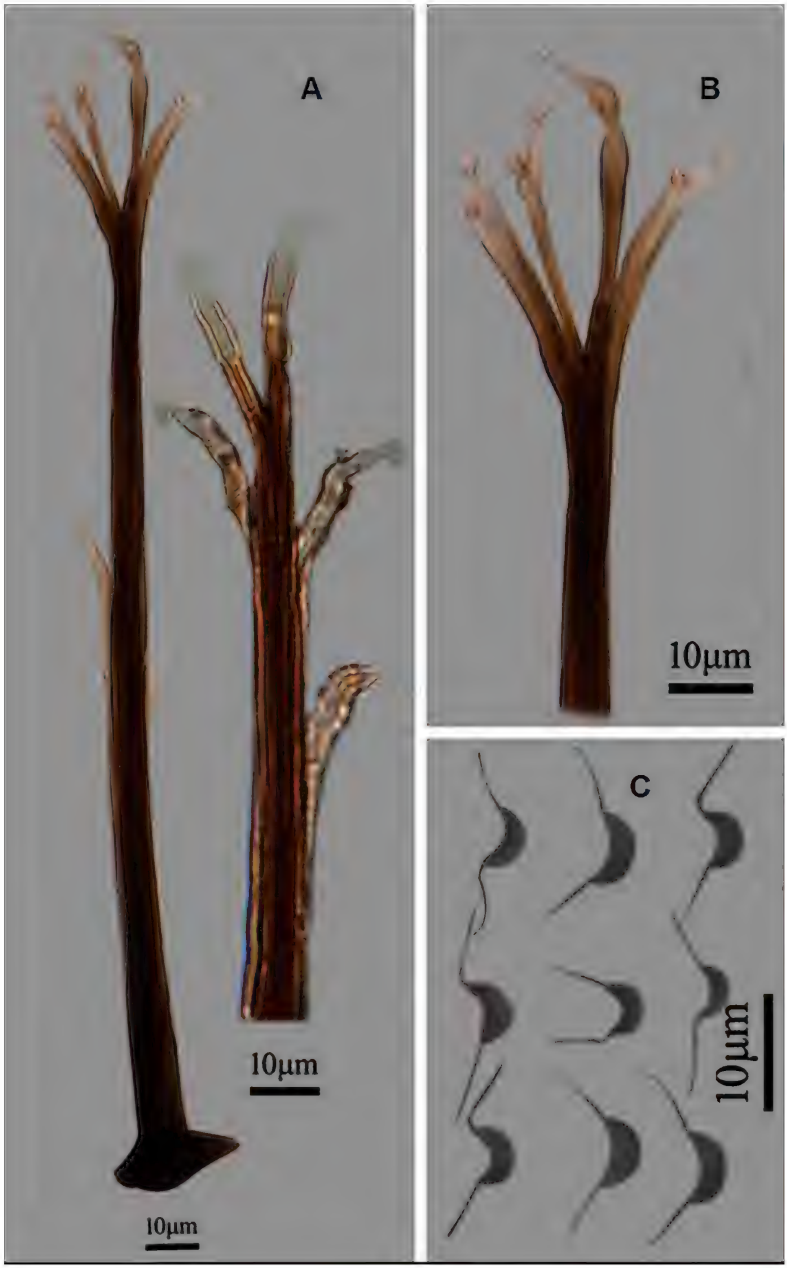

Fig. 1. *Codinaea delicata* (ex holotype USJ 83283). A–B. Conidiomata, conidiophores and conidiogenous cells. C. Conidia.

Fig. 2. *Codinaea delicata* (ex holotype USJ 83283).
Conidiomata, conidiophores, conidiogenous cell and conidia. Scale bars = 10 µm.

few sympodial extensions, terminal, integrated, brown to pale brown, with 1–3 funnel-shaped collarettes, 2.5–4 µm diam. and 3–4 µm deep. Conidia sublunate to subreniform, acuminate at the ends, unicellular, 6–7× 4–5 µm, hyaline, smooth-walled, with a filiform appendage, 7–9 µm long at each end; accumulating in white mucilaginous masses.

Notes: Among 41 *Codinaea* species recorded in Index Fungorum (2012), only one has synnematous conidiomata: *C. obesispora* S. Hughes & W.B. Kendr. That species and our new combination *C. dendroidea* (see below) share this character with *C. delicata*, but their conidia are falcate to broadly falcate and larger and so cannot be confused with those of *C. delicata*.

Three monematous *Dictyochaeta* species (*D. renispora* Whitton et al., *D. tilikfrei* Bhat & B. Sutton, *D. tropicalis* Bhat & W.B. Kendr.) are somewhat similar to *C. delicata*. *Dictyochaeta renispora*, found on decaying leaves of *Freycinetia excelsa*, *F. multiploa,* and *Pandanus* sp., has monophialidic conidiogenous cells with several percurrent extensions and ellipsoid to reniform, aseptate conidia, rounded at both ends, 6–8× 3–4 µm, with a filiform, 6–12 µm long appendage at both ends (Whitton et al. 2000). *Dictyochaeta tilikfrei,* found on decaying branches of an unidentified plant, has polyphialidic conidiogenous cells and broad fusiform to falcate, aseptate conidia, guttulate on the concave side, 20–25 × 10–12 µm, and obtuse at both ends with a filiform 6–12 µm long appendage at each end (Bhat & Sutton 1985). *Dictyochaeta tropicalis,* found on decaying leaves of an unidentified plant, produces ellipsoid to drop-shaped aseptate conidia, pointed at the apex, truncate to obtuse at the base, 7.5–9.5 × 3–5 µm, with a filiform straight 2.5–3 µm long apical appendix and a filiform curved ≤3.5 µm long appendix arising from one side of the broadly truncate base (Bhat & Kendrick 1993). No other monematous *Dictyochaeta* or *Codinaea* species are similar to *C. delicata*.

Codinaea dendroidea (Kuthub.) R.F. Castañeda, W.B. Kendr. & Minter, **comb. nov.**

MycoBank MB801579

≡ *Dictyochaeta dendroidea* Kuthub., Trans. Brit. Mycol. Soc. 89: 411 (1987).

This new combination is proposed because *Dictyochaeta dendroidea* has characters that fit the generic concept of *Codinaea*. It has synnematal conidiomata and polyphialidic conidiogenous cells with several inconspicuous lateral and terminal collarettes, and its conidia are falcate, hyaline, and with a filiform appendage at each end (Kuthubutheen 1987).

Key to synnematous *Codinaea* species

1. Conidia short and broad sublunate to subreniform, acuminate at the ends, unicellular, 6–7 × 4–5 µm, hyaline, smooth-walled, with a filiform appendage 7–9 µm long at each end ..... *C. delicata*

1. Conidiomata not sublunate or subreniform 2

2. Conidia falcate, unicellular, 12.5–16 × 2–3 µm, hyaline, smooth-walled, with a filiform appendage ≤6 µm long at each end ..... *C. dendroidea*

2. Conidia broadly falcate, unicellular, 17–21 × 5–6 µm, hyaline, smooth-walled, with a filiform appendage ≤6 µm long at each end ..... *C. obesispora*

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Ramichloridium apiculatum, a new record for China, causing sooty blotch and flyspeck

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Abstract — *Ramichloridium apiculatum* associated with sooty blotch and flyspeck is described and reported for the first time in China. The strains were isolated from the cuticle of pear and apple collected from orchards in Anhui and Jiangsu Provinces. Morphological characters and phylogenetic analysis, based on ITS sequences, indicated that the fungus is distinct from the other known species in the genus *Ramichloridium*.

Key words — *Dissoconiaceae*, *Capnodiales*, discrete speck, taxonomy, phylogeny

Introduction

Sooty blotch and flyspeck (SBFS) is a fungal complex that causes blemishes on the epicuticular wax layer of a variety of plants. It occurs in humid regions worldwide and is regarded as an economically serious disease (Batzer et al. 2008, Gleason et al. 2011, Li et al. 2012).

Ramichloridium was originally described by Stahel (1937), but the name was invalid because of the lack of a Latin diagnosis. The genus was validated by de Hoog (1977) with *Chloridium apiculatum* (*R. apiculatum*) as type species. The generic characters used for taxonomic circumscription by de Hoog (1977) were erect dark branched or non-branched conidiophores with different degrees of differentiation, sympodial proliferation, and aseptate conidia (Arzanlou et al. 2007). According to MycoBank (accessed March 30, 2014), more than 39 species of *Ramichloridium* have been proposed.

The objective of this paper is to identify and describe *Ramichloridium apiculatum* as a newly recorded causal agent of SBFS on pear and apple from China.

Materials & methods

Isolates and morphology

Strains were isolated from colonies displaying the discrete speck (DS) mycelial type (Batzer et al. 2005), LWHDSL1 (GenBank KC986369), LWHDSL5 (GenBank KC986370), LWHDSL26 (GenBank KC986371) were collected by WH Li on pear from orchards near Dangshang, Anhui Province and WLXZSN33 (GenBank KC986372), WLXZSN43 (GenBank KC986373) were collected by L Wang & YM Zhao on apple in Xuzhou, Jiangsu Province in China during October 2012. Individual sclerotium-like bodies (Batzer et al. 2005) were transferred from the surface of pear and apple to slants of potato-dextrose agar (PDA, Difco) and cultured at 25°C in the dark (Sun et al. 2003). After about 1 month, colonies were transferred to fresh PDA and malt extract agar (MEA, Difco) plates for describing and photographing. Additionally, hyphal tips from PDA slants were transferred to fresh PDA plates into which a sterile cover slip had been partially inserted into the agar at a 60° angle adjacent to the inoculum, in order to induce the fungus to grow onto the cover slip. Fungal fruiting structures that formed on the cover slips were examined, and 30 measurements were made of each feature.

Culture characteristics were described based on colonies on PDA plates at 25°C for one month and on MEA plates at 24°C for 14 d, both of which were incubated in darkness. Specimens and cultures were deposited in Fungal Laboratory, Northwest A&F University.

DNA extraction, PCR, and sequencing

The fungus was grown on PDA and genomic DNA was extracted following Li et al. (2011). The primer pairs ITS1-F (Gardes & Bruns 1993) and ITS4 (White et al. 1990) were used to amplify and sequence the internal transcribed spacer (ITS) region of nuclear ribosomal DNA. The PCR reaction consisted of 1 unit of Taq polymerase, 1 × PCR buffer, 2 mM $MgCl_2$, 0.2 mM of each dNTP, 0.4 µM of each primer, and 2 µL of template DNA, made up to a total volume of 25 µL with sterile water. Amplifications were performed on a Bio-Rad PCR System S1000TM Thermal Cycler. The PCR cycling parameters were initial denaturation at 94°C for 90 min, 35 cycles of denaturation at 94°C for 35 s, annealing at 52°C for 60 s, extension at 72°C for 1 min, and a final extension step at 72°C for 10 min. Sequencing of the PCR product was performed at Sangon Biotech (Shanghai, China).

Sequence alignment and phylogenetic analysis

All ITS nucleotide sequences were aligned with GenBank sequences that displayed a high degree of similarity. All related sequences and the outgroup *Mycosphaerella marksii* were imported into CLUSTAL-X (Thompson et al. 1997). Preliminary alignments were manually adjusted using BioEdit 5.0.9.1 (Hall 1999) where necessary.

The aligned DNA sequences underwent maximum parsimony analysis with PAUP vers. 4.0b (Swofford 2003). Heuristic searches were conducted with 1,000 random taxa addition. A majority consensus tree was constructed and clade stability was assessed by 1,000 bootstrap replications. Other measures were also calculated for parsimony, including tree length, consistency index, retention index, and rescaled consistency index (CI, RI and RC). The ITS sequences generated in this study were deposited in GenBank as accessions KC986369–986373.

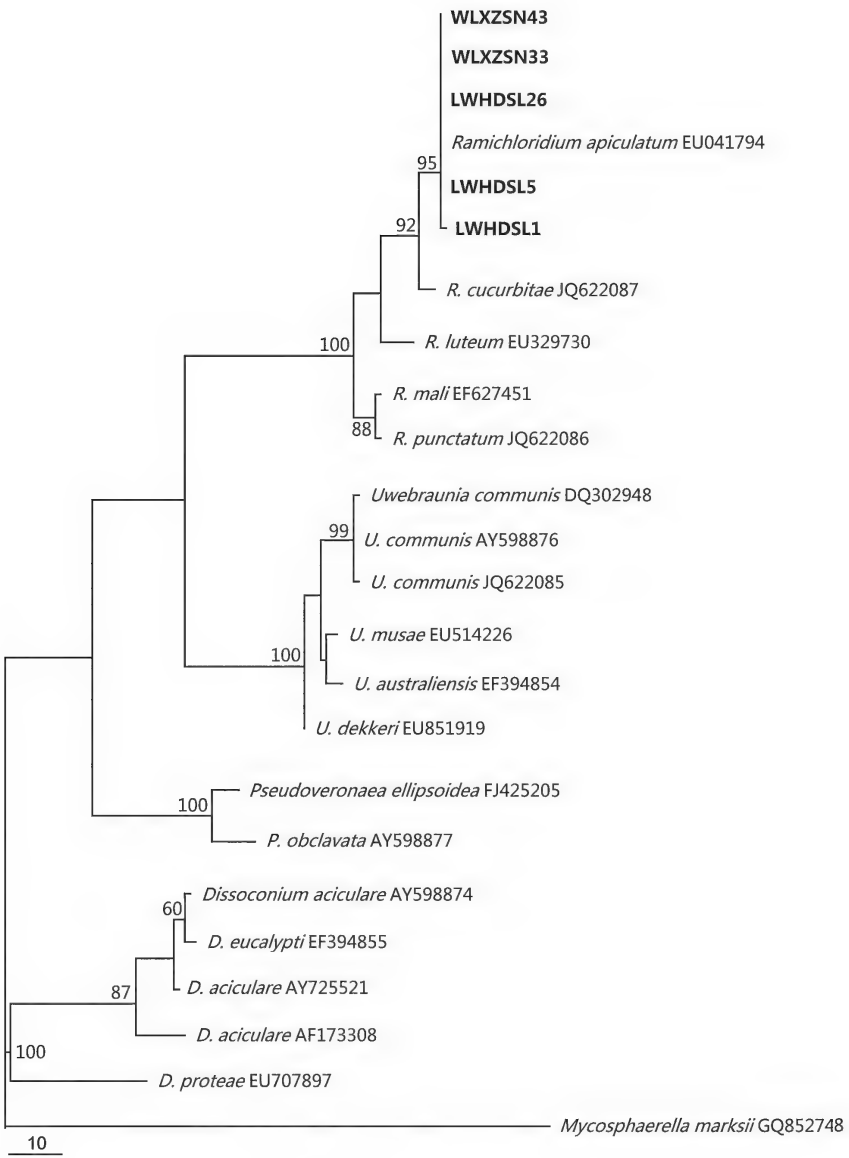

FIG. 1. One of 100 equally most parsimonious trees determined by ITS sequence (TL = 309 steps, CI = 0.7961, HI = 0.2039, RI = 0.9088, RC = 0.7235). Bootstrap support values (>50%) based on 1000 replicates are shown at the nodes. The scale bar denotes 10 changes. The tree is rooted to *Mycosphaerella marksii* and strains treated in this study are shown in bold.

Results

Phylogenetic analysis

The rDNA-ITS alignment for 24 taxa including the outgroup comprised 499 total characters, of which 322 were constant, 66 were parsimony-uninformative, and 111 were parsimony-informative; gaps were treated as "missing." One of 100 most parsimonious trees that were generated is shown in Fig. 1. *Ramichloridium* species separated into independent clades with well-supported bootstrap values. Our five strains clustered together with *R. apiculatum* to form a sub-clade with a bootstrap value of 95%, suggesting that these strains are conspecific with *R. apiculatum* (Fig. 1).

Taxonomy

Ramichloridium apiculatum (J.H. Mill., Giddens & A.A. Foster) de Hoog, Stud. Mycol. 15: 69, 1977 Fig. 2

Mycelium hyphae smooth, hyaline to subhyaline, thin-walled, 1.5–2.0 µm diam. Conidiophores erect, arising at right angles from superficial hyphae, unbranched, 1–3-septate, thick-walled, dark brown, ≤75 µm long. Conidiogenous cells integrated, terminal, subcylindrical, golden-brown, thick-walled, smooth, (23–)25–40(–48) × (1.5–)2–3(–3.5) µm; proliferating sympodially, forming a straight rachis with distinct scars; scars crowded near the apex of conidiogenous cells, slightly pigmented, <1 µm diam. Conidia (3–)4.5–5.5(–6.5) × (2–)2.5–3(–4) µm, solitary, aseptate, pale brown, obovate to obconical, finely verrucose, hilum conspicuous, 1 µm diam.

Cultural characteristics — Aerial mycelium spreading on MEA after 14 d at 24°C in the dark; flat, raised, dense, velvety, and with entire margin. Surface of the colony on MEA olivaceous-green, olivaceous-black in reverse, and often with a spreading citron-yellow pigment.

Host characteristics — On the fruit peels, the fungus showed flyspeck signs. Colonies lacked macroscopic dark mycelial mats, were circular or irregular, appeared as groupings (5–20 sclerotium-like bodies/mm^2) of tiny spheres (about 200 µm) that were classified as discrete speck (DS) mycelia type (Batzer et al. 2005).

Specimens examined: **China, Anhui Province**: Suzhou City, Dangshan County, 34°24′59″N 116°19′28″E, on fruit surface of pear (*Pyrus pyrifolia* (Burm. f.) Nakai), Oct. 2012, WH Li LWHDSL1 (GenBank KC986369), LWHDSL5 (GenBank KC986370), LWHDSL26 (GenBank KC986371). **Jiangsu Province**: Xuzhou City, Suining County, 33°59′46″N 117°44′31″E, on fruit surface of apple (*Malus domestica* Borkh.), Oct. 2012, L Wang & YM Zhao WLXZSN33 (GenBank KC986372), WLXZSN43 (GenBank KC986373).

Discussion

Ramichloridium species have various morphological characteristics and lifestyles, such as human pathogens, plant pathogens, and saprophytes

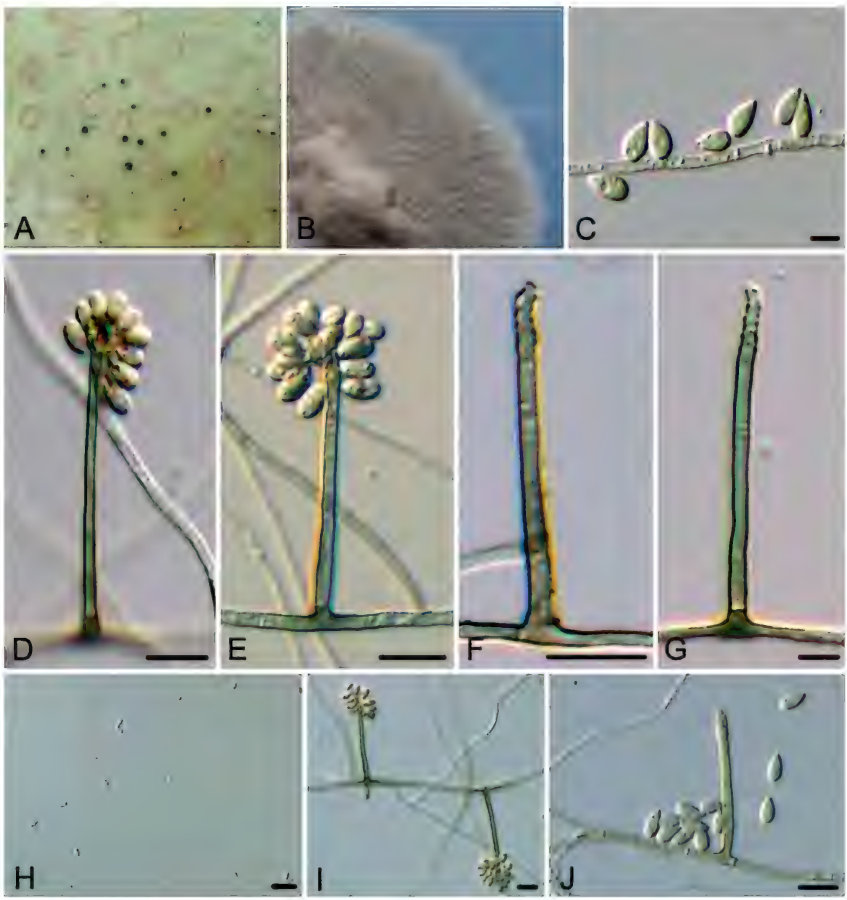

Fig. 2. *Ramichloridium apiculatum* (WLXZSN43). A. Discrete speck signs on pear; B. Colony on PDA; C, H. Conidia; D, E, I, J. Conidia and conidiogenous cells; F, G. Conidiophores. Scale bars: C, G = 5 μm; D–F, I, J = 10 μm; H = 20 μm.

(Arzanlou et al. 2007). *Ramichloridium apiculatum* was originally found in strongly deteriorated materials, in soil, and as a culture contaminant (de Hoog et al. 1977).

Among the pathogens commonly causing SBFS worldwide. *R. cucurbitae*, *R. punctatum,* and three other putative *Ramichloridium* species have been identified within the SBFS complex in the United States (Díaz Arias et al. 2010, Gleason et al. 2011, Li et al. 2012), while *R. luteum* (Li et al. 2012), *Dissoconium mali* (≡ *Ramichloridium mali*) (Zhang et al. 2007), and *R. streliziae* (Hao et al. 2013) are previously reported SBFS pathogens in China. This study, which

represents the first record of this species from China, provides the first evidence that *R. apiculatum* can be a causal agent of sooty blotch and flyspeck on apple and pear.

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New species of *Acrodictys* and *Repetophragma* from dead branches in China

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Abstract — Two new hyphomycetes are described and illustrated from specimens collected on dead branches in Hainan Province, China. *Acrodictys nigra* sp. nov. is characterized by terminal monoblastic conidiogenous cells bearing solitary ellipsoid or obovoid black conidia that consist of three columns of cells, with a protuberant portion at the basal cell. *Repetophragma hainanense* sp. nov. differs from other *Repetophragma* species in its smaller obovate to clavate one-septate brown to dark brown conidia.

Key words — anamorphic fungi, taxonomy

Introduction

A number of novel taxa have been recently discovered from the forest ecosystems of southern China (Dai et al. 2009; Zhang et al. 2009, 2012; Dai & Li 2010; Ma et al. 2011, 2012a,b; Ren et al. 2012). During an ongoing mycological survey in tropical forests of Hainan Province, China, two interesting hyphomycetes were collected on dead branches. Their morphological and developmental characteristics place these fungi in *Acrodictys* and *Repetophragma*. However, these fungi differ from all previously described taxa and therefore are proposed as new.

Acrodictys nigra Jian Ma & X.G. Zhang, **sp. nov.** Fig. 1

MycoBank MB 805612

Differs from *Acrodictys triarmata* by its larger conidia that lack lobes at the apex.

Type: China, Hainan Province: Baomeiling Nature Reserve, on dead branches of unidentified broad-leaved tree, 9 Dec. 2009, J. Ma (**Holotype**, HSAUP H5278; **isotype**, HMAS 243448).

Etymology: Latin, *nigra*, meaning black, referring to the pigmentation of the conidia.

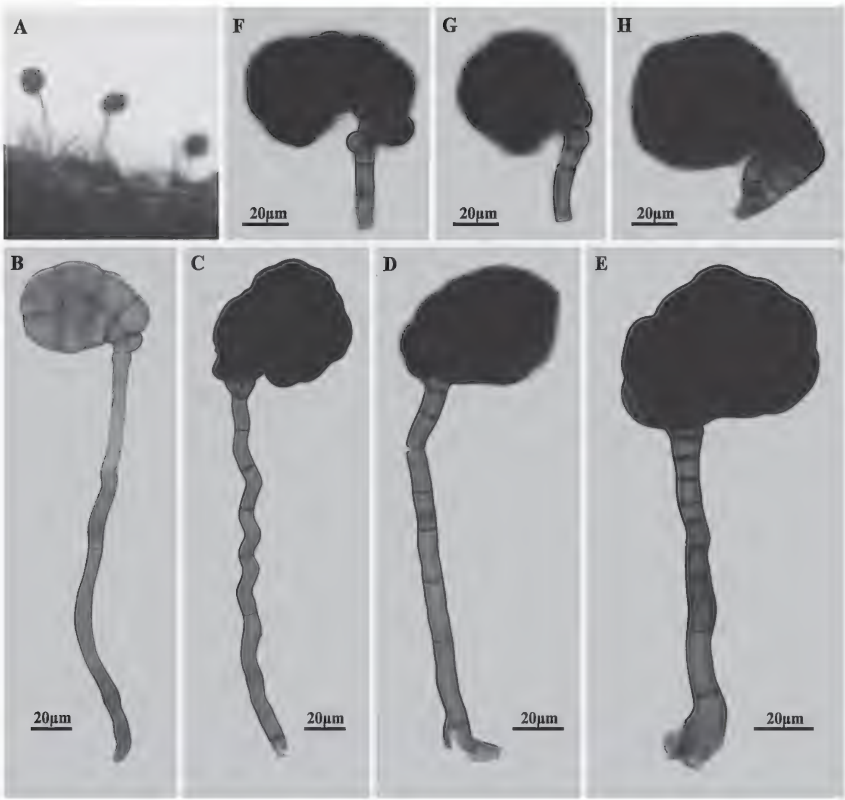

Fig. 1. *Acrodictys nigra* (holotype). A. Colonies on natural substratum. B–E. Conidiophores and conidia. F–H. Conidia.

Colonies effuse, consisting of individual brown conidiophores scattered over the substrate. Mycelium immersed and superficial, superficial hyphae pale brown, cylindrical, smooth, septate, branched. Conidiophores distinct, single, erect, straight or flexuous, cylindrical, septate, brown, smooth, 105–165 × 6.5–10.5 μm, sometimes with one percurrent extension. Conidiogenous cells monoblastic, integrated, terminal, brown, cylindrical, truncate. Conidial secession schizolytic. Conidia solitary, dry, acrogenous, consisting of three columns of cells, each column with 3–5 transverse septa, constricted at septa, ellipsoid, obovoid, or somewhat irregular in shape, smooth, black, septa obscured when mature, 48–105 × 37–56 μm, basal cell often with a protuberant portion of the conidiogenous cell attached.

Comments — Ellis (1961) established *Acrodictys* for the type species, *A. bambusicola* M.B. Ellis. He characterized the genus by dictyoseptate

pigmented conidia seceding schizolytically from monoblastic integrated terminal determinate or lageniform to doliiform percurrently extending conidiogenous cells. However, through the addition of numerous species the genus has become a large heterogeneous assemblage. Baker et al. (2002a), who reviewed the taxonomic condition and status of *Acrodictys*, placed four species into a segregate genus, *Junewangia* W.A. Baker & Morgan-Jones, and suggested that the circumscription of *Acrodictys* needed further refinement. Subsequently, several new anamorph genera, including *Rhexoacrodictys* W.A. Baker & Morgan-Jones (Baker et al. 2002b), *Pseudoacrodictys* W.A. Baker & Morgan-Jones (Baker & Morgan-Jones 2003), *Ramoacrodictys* G.Z. Zhao (Zhao et al. 2009), and *Synnemacrodictys* W.A. Baker & Morgan-Jones (Gams et al. 2009), were segregated to accommodate taxa that differ from the type species of *Acrodictys* in conidial morphology, conidiogenesis, conidial secession, and the kind of conidiomata.

Keys to *Acrodictys* species have been given by Ellis (1961, 1971, 1976), Sutton (1969), and Whitton et al. (2000). Only nine *Acrodictys* species have been previously reported from China (Whitton et al. 2000, Zhao et al. 2011). The present specimen, which can be placed in the original genus, differs significantly from all previously described species.

Acrodictys triarmata Whitton et al. is the species most similar to *A. nigra* in conidial shape and pigmentation. However, *A. triarmata* differs by its smaller (24–34 × 15–30 µm) and frequently tri-lobed conidia (Whitton et al. 2000).

Repetophragma hainanense Jian Ma & X.G. Zhang, **sp. nov.** FIG. 2

MycoBank MB 805613

Differs from *Repetophragma quadriloculare* by its smaller, concolourous conidia with 1 septum.

Type: China, Hainan Province: Bairentan Nature Reserve, on dead branches of unidentified broad-leaved tree, 10 Dec. 2010, J. Ma (**Holotype**, HSAUP H5505; **isotype**, HMAS 243449).

Etymology: refers to the province where the type specimen was found.

Colonies effuse on natural substratum, brown, hairy. Mycelium partly superficial, partly immersed, composed of branched, septate, pale brown to brown, smooth-walled hyphae. Conidiophores distinct, single, cylindrical, solitary, unbranched, erect, straight or flexuous, 6–10-septate, smooth, dark brown to black, 110–155 µm long, 4–6.5 µm wide, with up to 10 (or sometimes more) percurrent extensions. Conidiogenous cells monoblastic, integrated, terminal, cylindrical, brown to dark brown, 1.5–2.5 µm wide at the apex. Conidial secession schizolytic. Conidia holoblastic, acrogenous, solitary, dry, obovoid to clavate, brown, slightly darker at the apex, smooth-walled, 1-euseptate, 9.5–15 µm long, 4–6.5 µm wide in the broadest part, base truncate and 1–2 µm wide, apex rounded.

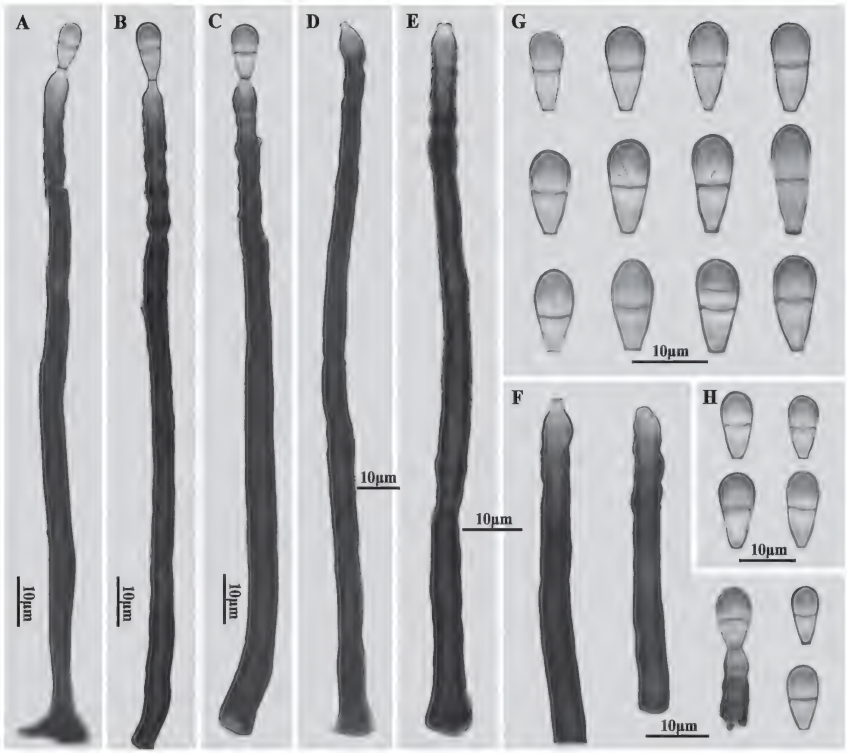

Fig. 2. *Repetophragma hainanense* (holotype). A–C. Conidiophores with terminal conidia with conidiophore apices showing conidiogenous cells and percurrent extensions. D–E. Conidiophores. F. Conidiogenous cells and conidia. G–H. Conidia.

Comments — Subramanian (1992) established *Repetophragma* Subram. with nine new combinations for species of *Sporidesmium* Link, citing *R. biseptatum* (M.B. Ellis) Subram. as the type species. *Repetophragma* was characterized by the production of acrogenous conidia that are solitary, obclavate, fusiform or rostrate, truncate at the base, rounded at the apex, euseptate, and seceding schizolytically from monoblastic integrated terminal percurrently extending conidiogenous cells. Thirty-three taxa have been published in *Repetophragma* (Subramanian 1992; McKenzie 1995; Mena-Portales et al. 2000; Wu & Zhuang 2005; Castañeda-Ruíz et al. 2006, 2011; Marincowitz et al. 2008; Silvera-Simón et al. 2009; Rambelli et al. 2011). Castañeda-Ruíz et al. (2011) provided a synoptic table of the morphological characters of all *Repetophragma* species (except *R. lignicola* (S. Hughes) Rambelli) and illustrated representative conidia. Assigning species to *Repetophragma* is primarily based on conidial morphology such as shape, size, septation, ornamentation, and presence or

absence of a rostrum (Subramanian 1992, Wu & Zhuang 2005, Marincowitz et al. 2008, Silvera-Simón et al. 2009, Castañeda-Ruíz et al. 2011).

Repetophragma quadriloculare (Matsush.) R.F. Castañeda et al. is the species most similar to *R. hainanense* in conidial shape. However, *R. quadriloculare* differs by its much larger (16.5–21 × 8.5–13 μm), 3-septate, versicoloured conidia (Matsushima 1993, as *Endophragmiella quadrilocularis*).

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Ceratosporium hainanense and *Solicorynespora obovoidea* spp. nov., and a first record of *Bactrodesmiastrum obscurum* from southern China

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Abstract — Two new anamorphic fungi, *Ceratosporium hainanense* sp. nov. and *Solicorynespora obovoidea* sp. nov., were collected on dead branches in tropical forest of southern China. They are described, illustrated, and compared with similar taxa. *Bactrodesmiastrum obscurum* is recorded for the first time from China. A key to *Ceratosporium* species is provided.

Key words — anamorphic fungi, taxonomy

Introduction

Our surveys of conidial fungi occurring on dead branches in the forest ecosystems of southern China have yielded three new genera (Ren et al. 2012, Zhang et al. 2012), and several new species and records for China (e.g. Zhang et al. 2008, 2009, 2011; Ma et al. 2011, 2012a,b). During continuing exploration for saprobic microfungi in these forests, three hyphomycetes of the genera *Ceratosporium* Schwein., *Solicorynespora* R.F. Castañeda & W.B. Kendr., and *Bactrodesmiastrum* Hol.-Jech. were collected on dead branches. *Ceratosporium hainanense* and *Solicorynespora obovoidea* are described here as new species, and *Bactrodesmiastrum obscurum* represents a new record from China.

Ceratosporium hainanense Jian Ma & X.G. Zhang, **sp. nov.** Fig. 1

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Differs from *Ceratosporium gracile* and *C. indicum* by its smooth conidia with a conspicuous pyriform basal cell and more arms, which are shorter and contain fewer

Fig. 1. *Ceratosporium hainanense* (holotype). Conidiophores and conidia.

septa and from *C. caribense* by its conidia with a conspicuous pyriform basal cell and fewer arms.

Type: China, Hainan Province: Lingao, on dead branches of unidentified broad-leaved tree, 9 Dec. 2010, J. Ma (**Holotype**, HSAUP H5488; **isotype**, HMAS 243445).

Etymology: refers to the province where the type was found.

Colonies effuse, dark brown. Mycelium superficial and immersed, composed of branched, septate, pale brown to brown, smooth-walled hyphae. Conidiophores undifferentiated, smooth, brown, 4–6.5 μm long, 2.5–3.5 μm wide, scattered on the superficial mycelium. Conidiogenous cells integrated, intercalary, monoblastic, determinate, cylindrical, denticulate. Conidia solitary, basal cell single, pyriform, brown, smooth, with an obvious scar, 3–4 μm wide; 3–5 arms arising from the apex, arms united and closely adpressed at the base, distal ends of arms straight or flexuous and divergent, brown, pale brown toward the apex, smooth, arms 6–14-septate, not constricted at the septa, 75–140 μm long (most of unequal length), 5.5–7.5 μm wide at the base and tapering to 2–3 μm wide at the apex.

Comments – Schweinitz (1832) established *Ceratosporium* with *C. fuscescens* Schwein. as type species. Subsequently, Hughes (1951) gave a detailed account of conidial development and the taxonomy of *Ceratosporium* species. Hughes (1964) re-described *C. fuscescens* and *C. rilstonei* S. Hughes from New Zealand collections, drawing attention to the occurrence of secondary conidial fructifications. The genus is characterized by inconspicuous flexuous

brown conidiophores and integrated intercalary monoblastic determinate denticulate conidiogenous cells that produce solitary conidia with a central cell and divergent pluriseptate branches (Ellis 1971). Ten species are currently accepted in *Ceratosporium* (Kirschner & Chen 2004), of which six produce smooth conidia and four produce verrucose conidia. Only four species have been previously recorded from China (Zhao et al. 2010).

Ceratosporium hainanense is closely related to *C. gracile* Matsush., *C. indicum* V.G. Rao & D. Rao, and *C. caribense* Hol.-Jech. in conidial shape. However, *C. gracile* and *C. indicum* differ from *C. hainanense* by their verrucose conidia without a pyriform basal cell and with arms that are fewer, longer, and more septate (Matsushima 1981, Rao & Rao 1970); *C. caribense* differs by its conidia without a pyriform basal cell and with more and shorter arms (Holubová-Jechová 1988).

Key to species of *Ceratosporium*

1. Conidia V- or Y-shaped, each of the 2 divergent branches arising from conidial apex 2
1. Conidia with 2–3 or more arms united at base, distal ends of arms divergent 3
2. Conidia V-shaped, verrucose, lateral arms subulate, 12–24 µm long, 3.5–4.5 µm wide at the base, 1–3-septate ..... ***C. aequatoriale***
2. Conidia Y-shaped, smooth, lateral arms subulate, 20–90 µm long, 5.5–10 µm wide at base, 1–9-septate ..... ***C. cornutum***
3. Conidia with 2–5 arms that are 20–32 × 4–6 µm, 6–10-septate ..... ***C. palmiforme***
3. Conidia with 2–3(–4), 3–5, or 5–6 arms that are ≥34 µm long, >7 µm wide at base ... 4
4. Conidia smooth 5
4. Conidia verrucose 9
5. Arms of conidia united and closely adpressed at base, sometimes coiled around each other 6
5. Arms of conidia united, not closely adpressed or intertwined at base 8
6. Conidia with 3–5 arms that are75–140 µm long, 5.5–7.5 µm wide at base, 2–3 µm wide at apex, 6–14-septate ..... ***C. hainanense***
6. Conidia with 2–3 or 5–6 arms that are >180 µm long, ≥8 µm wide at base, (5–)6–8 µm wide at apex 7
7. Conidia with 5–6 arms that are 90–340 µm long, 8–16 µm wide at base, 5–8 µm wide at apex, 9–15-septate ..... ***C. caribense***
7. Conidia with 2–3 arms that are 130–190 µm long, 14–17 µm wide at base, 6–8 µm wide at apex, 8–14-septate ..... ***C. rilstonei***
8. Conidia with 2–4 arms that are 90–180 µm long, 11–15 µm wide at base, 3.5–5.5 µm wide at apex, 10–14-septate ..... ***C. productum***
8. Conidia with 2–3 arms that are 120–210 µm long, 14–22 µm wide at base, 5–10 µm wide at apex, 11–17-septate ..... ***C. fuscescens***

9. Conidia with 2–3 arms that are34–56 µm long, 12–14 µm wide at base, 7–11-septate ..... ***C. verrucosum***

9. Conidial arms >180 µm long, ≤10 µm wide at base, ≤23–24 septate **10**

10. Conidia with 2–3 arms, that are 36–192 µm long, 6–10 µm wide at base, 2.5–3.5 µm wide at apex, 5–24-septate ..... ***C. gracile***

10. Conidia with 2–3 arms that are140–378 µm long, 3.6–7.2 µm wide at base, up to 3.6 µm wide at apex, 14–23-septate ..... ***C. indicum***

Solicorynespora obovoidea Jian Ma & X.G. Zhang, **sp. nov.** FIG. 2

MycoBank MB 805615

Differs from all other *Solicorynespora* species by its obovoid conidia with septa usually obscured by a band of pigment.

TYPE: China, Guangdong Province: Liuxihe National Forest Park, on dead branches of unidentified broad-leaved tree, 18 Oct. 2010, J. Ma (**Holotype**, HSAUP H5513; **isotype**, HMAS 243446).

ETYMOLOGY: refers to the obovoid conidial shape.

COLONIES on natural substrate effuse, brown to dark brown, hairy. Mycelium superficial and immersed, composed of hyphae that are branched, septate, pale brown to brown, smooth-walled. CONIDIOPHORES distinct, single, solitary or in groups, erect, straight or flexuous, unbranched, smooth, septate, brown to dark brown, 80–115 µm long, 4.5–7 µm wide, sometimes with 1 lageniform percurrent extension. CONIDIOGENOUS CELLS monotretic, integrated, terminal, cylindrical or lageniform, pale brown to brown, smooth, 11–16 µm long, 3.5–4.5 µm wide. CONIDIA solitary, dry, acrogenous, obovoid, apex rounded, base truncate, 2-euseptate, the septa usually obscured by a dark band, smooth, brown to dark brown, basal cell paler; 16–22 µm long, 9–11 µm wide in the widest part, 1.5–2.5 µm wide at the base. Conidial secession schizolytic.

COMMENTS – Castañeda Ruíz & Kendrick (1990) established *Solicorynespora* with *S. zapatensis* R.F. Castañeda & W.B. Kendr. as type species. *Solicorynespora* is characterized by solitary brown to dark brown euseptate phragmoconidia that are produced from integrated terminal monotretic conidiogenous cells. The conidiophores are distinct and determinate or percurrently extending one or more times. Siqueira et al. (2008) summarized the essential characteristics of *Solicorynespora* and similar genera including *Corynespora* Güssow, *Corynesporella* Munjal & H.S. Gill, *Hemicorynespora* M.B. Ellis, *Corynesporopsis* P.M. Kirk, and *Corynesporina* Subram. and discussed the distinguishing characters of these genera.

The twenty-one species accepted in *Solicorynespora* are distinguished primarily on conidial features including shape, size, septation, ornamentation, pigmentation, and presence or absence of an appendage (Castañeda Ruíz 1996, Castañeda Ruíz et al. 2004, Ma et al. 2012b,c). Keys to *Solicorynespora*

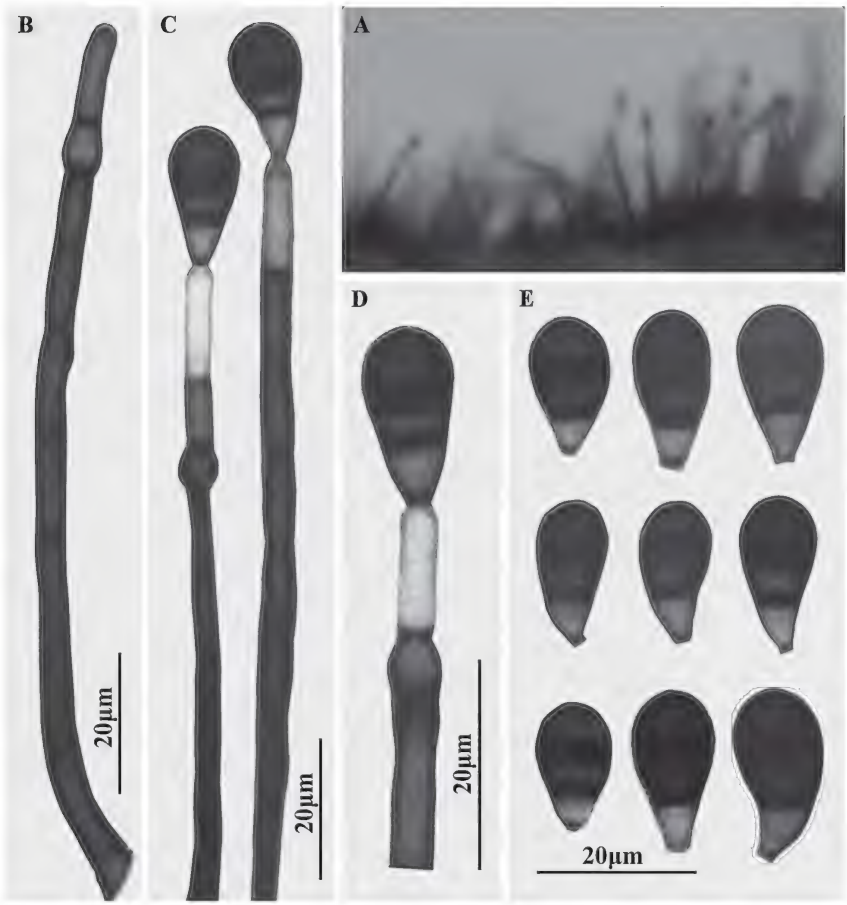

FIG. 2. *Solicorynespora obovoidea* (holotype). A. Colonies on natural substratum. B. Conidiophore. C–D. Conidiophores and conidia. Conidiophore apices showing conidiogenous cells and percurrent extension. E. Conidia.

species have been given by Castañeda Ruíz et al. (2004), Ma et al. (2012c), and Hernández-Restrepo et al. (2014) based mainly on conidial morphology. In addition, Ma et al. (2012c) provided a synoptic table of the main morphological features that distinguish 15 accepted *Solicorynespora* species. Hernández-Restrepo et al. (2014) illustrated representative conidia of 21 species and revealed the high affinity of *Solicorynespora insolita* Hern.-Restr. et al. with the family *Kirschsteiniotheliaceae* and a particularly close affinity with *Astrosphaeriella livistonicola* K.D. Hyde & J. Fröhl. based on the 28S rDNA D1/D2 sequence. Teleomorphs and phylogenetic affinities of other *Solicorynespora* species based on molecular sequence analyses are not yet known.

Solicorynespora obovoidea bears some resemblance to three other species with 2-septate conidia: *S. biseptata* Silvera et al., *S. calophylli* (Hol.-Jech. & R.F. Castañeda) R.F. Castañeda & W.B. Kendr., and *S. lasianthi* L.G. Ma & X.G. Zhang. However, *S. biseptata* differs by its slightly smaller obclavate conidia with the dark brown basal and middle cells and the pale brown apical cell (Hernández-Restrepo et al. 2014); *S. calophylli* differs by its smaller obclaviform to obpyriform conidia, strongly constricted at the septa, with the verrucose brown basal and middle cells and the rostrate subhyaline to hyaline apical cell (Holubová-Jechová & Castañeda Ruíz 1986, as *Corynespora calophylli*); and *S. lasianthi* differs by its smaller cylindrical to ellipsoid conidia with the pale brown basal cell and the brown middle and apical cells (Ma et al. 2012d).

Bactrodesmiastrum obscurum Hol.-Jech., Folia Geobot. Phytotax. 19(1):105, 1984. Fig. 3

Colonies on natural substratum effuse, blackish brown to black. Mycelium superficial and immersed, composed of branched, septate, pale brown, smooth-walled hyphae. Conidiophores distinct, but reduced to a single conidiogenous cell, solitary at first, later aggregated in small groups. Conidiogenous cells borne on basal hyphae, monoblastic, cylindrical or lageniform, brown to dark brown, 6.5–12 × 2–3.5 µm, 1–1.5 µm wide at the truncate apex. Conidia solitary, dry, acrogenous, straight or slightly curved, clavate to obovoid, mostly 3-septate, rarely 4-septate, smooth, dark brown to black, two proximal cells paler than others, 25–34 × 10–14 µm, basal cell conico-truncate, basal scar 1–1.5 µm wide. Conidial secession schizolytic.

Specimen examined: **China**, **Hainan Province**: Jianfengling National Nature Reserve, on dead branches of unidentified broad-leaved tree, 27 April 2006, J. Ma (HSAUP VI_0-0041, HMAS 243447).

Comments – *Bactrodesmiastrum* was erected by Holubová-Jechová (1984) with *B. obscurum* as type species. The genus remained monotypic until Hernández-Restrepo et al. (2013) described *B. pyriforme* Hern.-Restr. et al. and *B. obovatum* (M. Calduch et al.) J. Mena et al. from decaying wood in Spain. ITS and LSU rDNA sequence analyses have confirmed the separation between *B. obovatum* and *B. pyriforme*, but sequence data are not yet known for *B. obscurum* (Hernández-Restrepo et al. 2013). *Bactrodesmiastrum* is mainly characterized by short unbranched aseptate cylindrical to conical solitary or aggregated conidiophores reduced to a single monoblastic terminal determinate conidiogenous cell and solitary clavate obovoid to pyriform multiseptate conidia with schizolytic conidial secession. *Bactrodesmiastrum* differs from the most similar genus, *Bactrodesmium* Cooke, which has sporodochial conidiomata and differentiated hyaline or brown simple or branched conidiophores bearing mono- or polyblastic conidiogenous cells (Ellis 1971, Holubová-Jechová 1972).

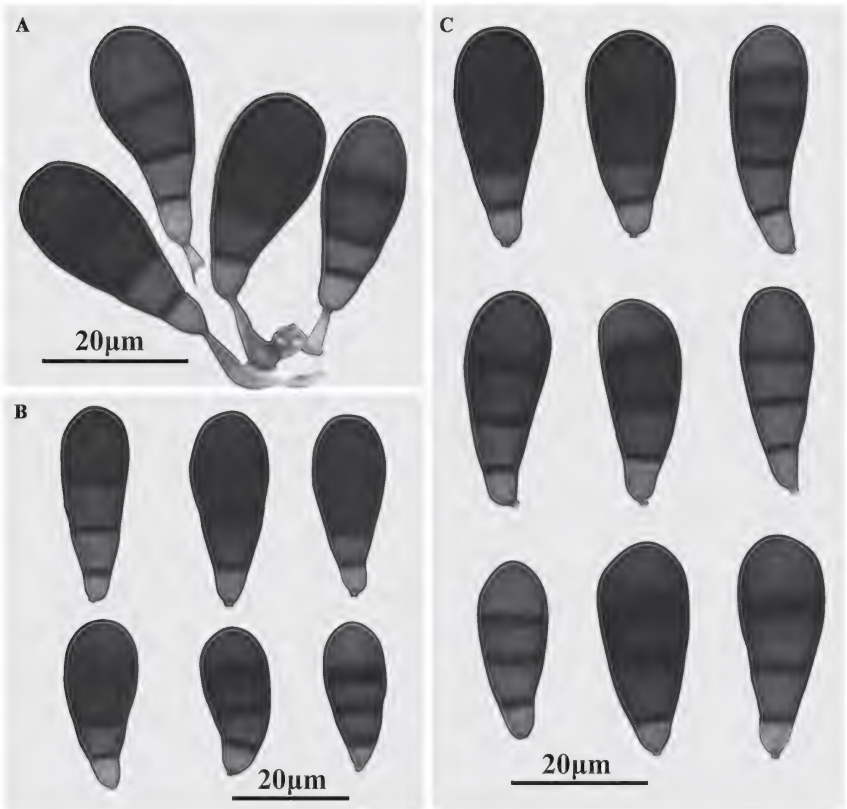

FIG. 3. *Bactrodesmiastrum obscurum*. A. Conidiogenous cells and conidia. B–C. Conidia.

Bactrodesmiastrum obscurum was found originally on decaying wood of *Fagus sylvatica* in Czechoslovakia. It is also known from Spain on dead wood and has been re-described by Hernández-Restrepo et al. (2013). Its known distribution is now extended to include China. *Bactrodesmiastrum obscurum* differs from the other two species in the genus by its clavate to obovoid conidia with two paler proximal cells. It further differs from *B. pyriforme* in its smaller conidia, and from *B. obovatum* in its conidia with predominately three septa. The Chinese collection corresponds well with the original description of *B. obscurum* except that the conidia occasionally display four septa. This fungus is reported for the first time from China.

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Paliphora curviapicis sp. nov. from Malaysia, and a synopsis of the genus

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Abstract— *Paliphora curviapicis* sp. nov., collected from submerged wood in Malaysia, is described and illustrated. It differs from other *Paliphora* species in having conidia with a curved apex and 3–6 distinct septa. A synopsis of characters of the six known species and a composite illustration of their conidial morphology are provided.

Key words— freshwater fungi, dematiaceous hyphomycete, lignicolous fungi, saprotroph, taxonomy

Introduction

Species of *Paliphora* Sivan. & B. Sutton (Sivanesan & Sutton 1985) are hyphomycetes characterized by dematiaceous, setiform, unbranched, thick-walled, closely multiseptate conidiophores that produce hyaline unicellular or euseptate conidia through pores on the conidiogenous cells (tretic conidiogenesis; Ellis 1971). Amongst the few dematiaceous hyphomycete genera characterized by setiform conidiophores exhibiting tretic conidiogenesis, *Paliphora* species are distinct in producing hyaline aseptate or euseptate conidia (Ho et al. 2002). In similar genera such as *Diplococcium* Grove, *Spadicoides* S. Hughes, *Polytretophora* Mercado, and *Helminthosporium* Link, the conidia are pigmented and either euseptate or distoseptate (Goh & Hyde 1996, 1998; Goh et al. 1998, Kuthubutheen & Nawawi 1991). There are five reported species of *Paliphora* (Index Fungorum 2013), all of which occur on decaying leaves. Gusmão et al. (2008) examined and provided a key to the five species.

Paliphora species are widely distributed in the tropics, including Australia (Sivanesan & Sutton 1985, Alcorn 1996), Brazil (Gusmão et al. 2008), Cuba, India (Rao & de Hoog 1986), Malaysia (Kuthubutheen 1987), Mexico (Heredia

et al. 2000), New Caledonia (Mouchacca 1990), and southern Thailand (Gusmão et al. 2008).

During a survey of fungal diversity from abandoned tin-mining ponds and associated streams in the Kinta Valley region, Malaysia, we found an undescribed *Paliphora* species on wood submerged in a stream. This species is described here and compared with other *Paliphora* species. The holotype is conserved at the herbarium of the Centre for Biodiversity Research, Faculty of Science, Universiti Tunku Abdul Rahman (Perak campus), Kampar, Malaysia (UTAR). The conidiogenous holes on the conidiophores and other ultrastructural features of this fungus were studied under the scanning electron microscope (FESEM, Model: JSM-6701F, Jeol, Japan).

Taxonomy

Paliphora curviapicis Goh, W.Y. Lau & K.C. Teo, **sp. nov.** Figs 1–15

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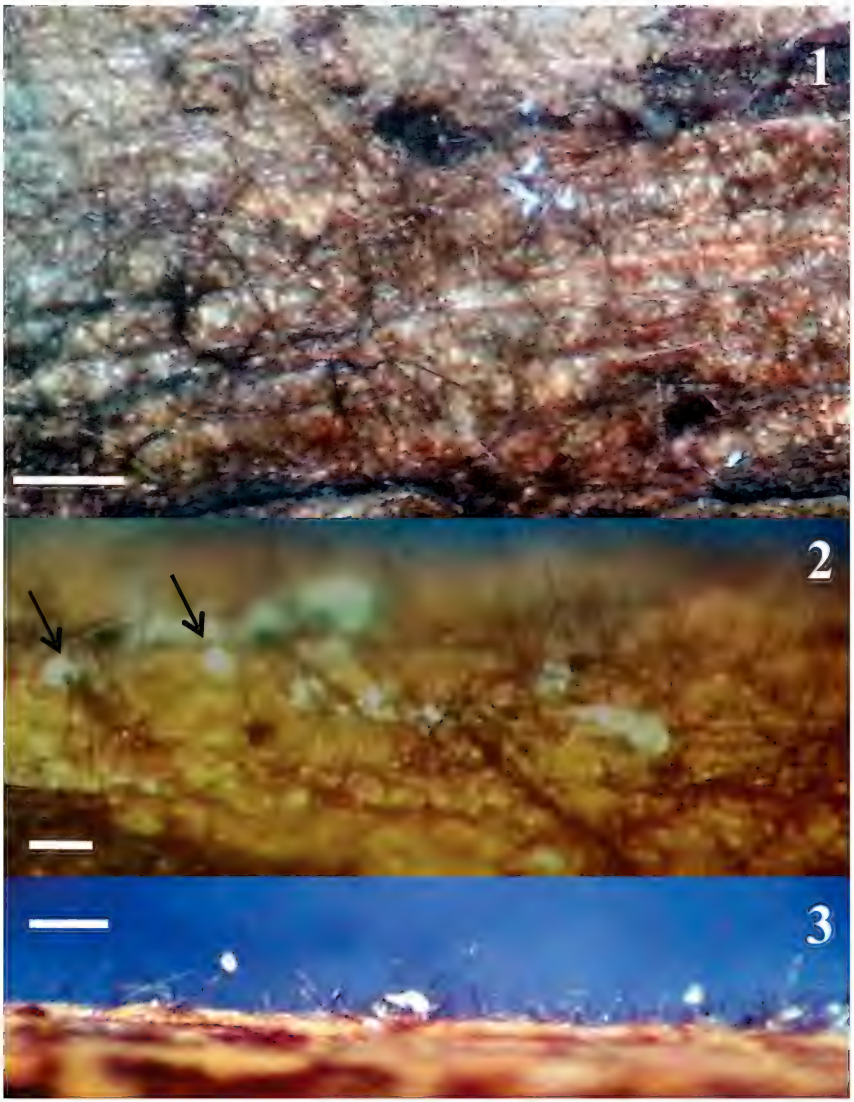
Differs from *Paliphora multiseptata* by its conidia with a curved apex and fewer septa, and its substrate of dead wood; and from other species of *Paliphora* by its conidia with a curved apex and more septa, and its substrate of dead wood.

Type: Malaysia. Perak, Menglembu, Bukit Kledang, on submerged wood, 16 September 2013, Wai-Yip Lau (**Holotype**, UTAR(M)-0002).

Etymology: *curviapicis*, refers to the characteristically curved apex of the conidia.

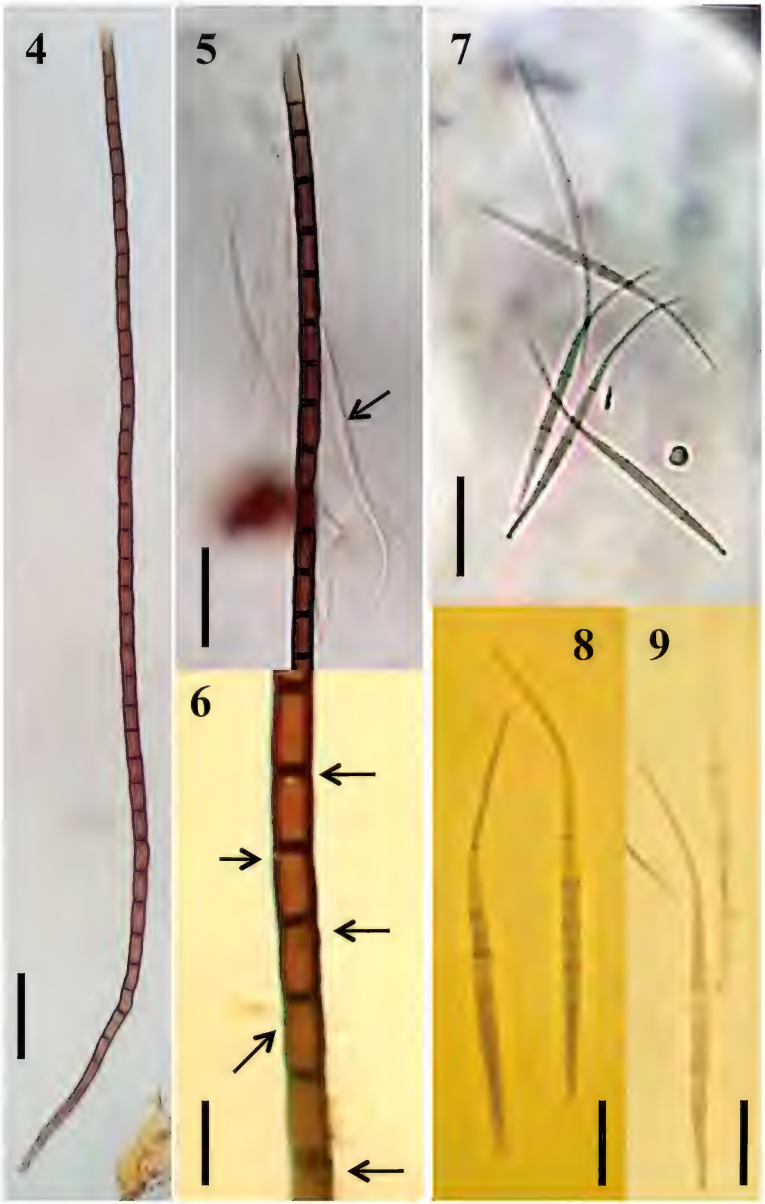
Colonies on natural substratum effuse, sparsely velvety, dark brown. Conidiophores macronematous, mononematous, setiform, 170–540 µm long, 4.5–5 µm wide, lower portion gradually tapering towards the base (2.5–3 µm wide), erect or becoming prostrate due to the length, unbranched, mostly straight, stout, thick-walled, smooth, brown, apical cell rounded and paler, with 20–63 evenly spaced (5–10 µm apart) thick septa along the shaft, slightly constricted at the septa. Conidiogenous cells integrated, intercalary, determinate, polytretic, with 1–3 pores (ca. 0.5 µm diam.) situated immediately below the thick transverse septum and often obscured by the septum. Conidia holoblastic, formed through pores in the conidiogenous cell wall, solitary, aggregated into slimy masses, thin-walled, smooth, hyaline, eguttulate, 3–6-euseptate, not constricted at the septa, elongate-fusiform or narrowly falcate, sometimes slightly sigmoid, 40–70 µm long, 2–3 µm wide at the center, tapering to an acute or obconic base, upper third slender (0.7–1.5 µm wide) or filiform and distinctly curved, tapering towards an acute apex.

Comments — *Paliphora curviapicis* is the second *Paliphora* species found in Malaysia; the previously recorded species was *P. porosa* (Kuthubutheen 1987). The other five *Paliphora* species are easily distinguished from *P. curviapicis*

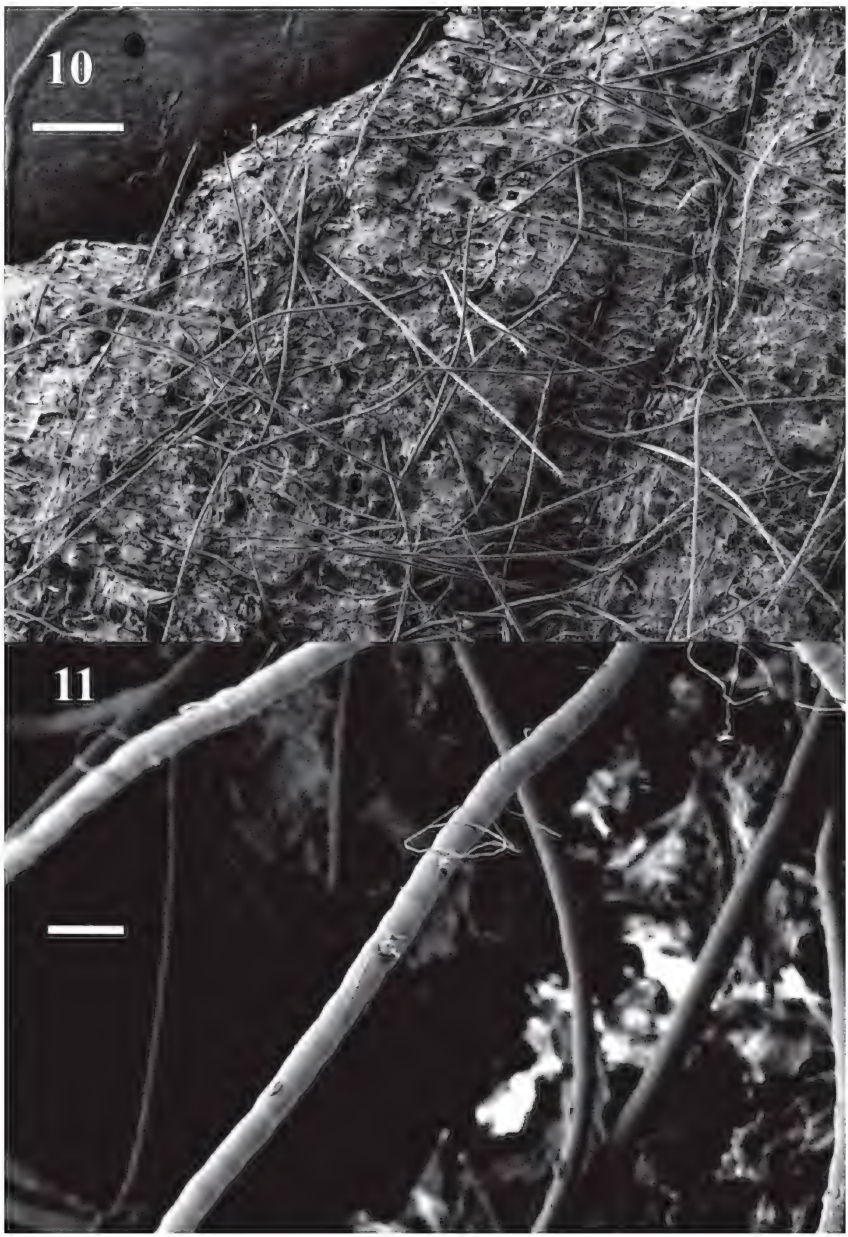


Figs 1–3. *Paliphora curviapicis* (holotype), colonies on natural substratum. 1. Surface view. 2. Oblique surface view; arrows point to slimy conidial masses. 3. Side view. Scale bars: 1, 3 = 500 µm; 2 = 200 µm.

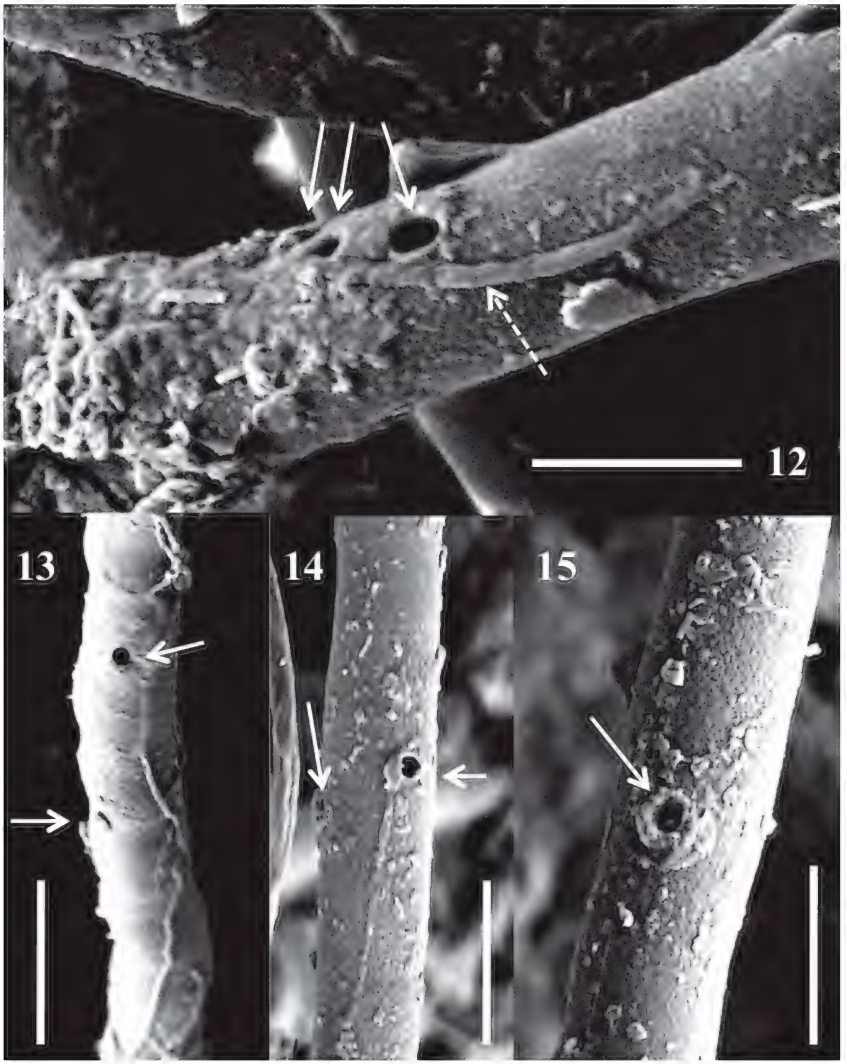
by their cylindrical, clavate, or falcate conidia with either more septa (*P. multiseptata*) or fewer septa (the other four species) and their substrate



Figs 4–9. *Paliphora curviapicis* (holotype). 4. Conidiophore with evenly spaced septa and uniform width but tapering toward the base. 5. Distal end of a conidiophore with a few conidia; arrow points to a sigmoid conidium. 6. Higher magnification of a conidiophore; arrows indicate the positions of several conidiogenous pores. 7–9. Multiseptate conidia with obconic base and slender curved apex. Scale bars: 4, 5, 7 = 20 µm; 6, 8, 9 = 10 µm.



Figs 10–11. *Paliphora curviapicis* (holotype, SEM). 10. Colonies on natural substratum. 11. Higher magnification of a few conidiophores with smooth walls. Scale bars: 10 = 100 µm; 11 = 10 µm.



Figs 12–15. *Paliphora curviapicis* (holotype, SEM). 12. Portion of conidiophore showing three conidiogenous pores (arrows) – the dashed arrow points to a conidium beside the pores. 13–15. Portions of conidiophores; arrows indicate positions of conidiogenous pores. Scale bars = 5 µm.

of dead leaves (Table 1, Fig 16). The characteristically filiform and curved conidial apex and the sometimes sigmoid conidial shape may be conducive to spore dispersal and establishment of this species in the aquatic environment (Hyde & Goh 2003).

Table 1. Synopsis of *Paliphora* species

Species	Conidiophores	Conidia	Substratum	Distribution	References
P. aurea	Apical end pointed, 11–23-septate, 99–132 × 6–7 µm	Falcate, eguttulate, 0(–1)-septate, 6.5–9 × 1–1.5 µm	Decaying leaves	Australia, India, New Caledonia	Mouchacca 1990, Sivanesan & Sutton 1985, Rao & de Hoog 1986
P. curviapicis	Apical end rounded, 20–63-septate, 170–540 × 4.5–5µm	Elongate-fusiform with a slender, curved apex, eguttulate, 3–6-septate, 40–70 ×2–3µm	Submerged wood	Malaysia	This paper
P. inflata	Apex swollen, end pointed, 13–19-septate, 142.5–225 × 5–7.5 µm	Cylindrical, eguttulate, 0-septate, 17–20 × 1.2–2 µm	Decaying leaves	Brazil	Gusmão et al. 2008
P. intermedia	Apical end pointed, 16–22-septate, 35–205 × 10–19 µm	Cylindrical, guttulate, 1-septate, 14–19 × 2–2.5 µm	Decaying leaves	Australia, Brazil, Cuba, Mexico	Alcorn 1996, Gusmão et al. 2008
P. multiseptata	Apical end pointed, 14–16-septate, 85–210 × 6–7.5 µm	Cylindrical, eguttulate, 8–13-septate, 50–65 × 2.5 µm	Decaying leaves	Brazil	Gusmão et al. 2008
P. porosa	Apical end pointed, 15–23-septate, 200–280 × 10–15 µm	Cylindrical or clavate, guttulate, 1-septate; 12–25 × 1–2.5 µm	Decaying leaves	Brazil, Malaysia, Thailand	Gusmão et al. 2008, Kuthubutheen 1987

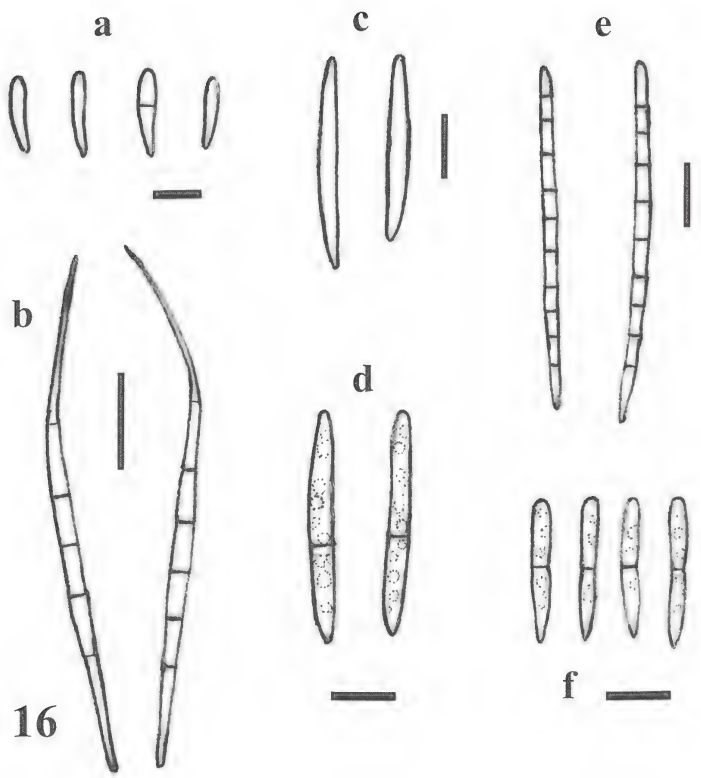


Fig 16. Composite diagram of *Paliphora* conidia: (a) *P. aurea*; (b) *P. curviapicis*; (c) *P. inflata*; (d) *P. intermedia*; (e) *P. multiseptata*; (f) *P. porosa*. Scale bars: a, c, d, f = 5 µm; b, e = 10 µm.

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A new species of *Corynesporopsis* from Spain

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Abstract — *Corynesporopsis variabilis* sp. nov., found on plant debris collected in natural areas of Spain, is described and illustrated. It is characterized by an endogenous conidial ontogeny at the reduced internal area of inflated conidiogenous cells and long acropetal chains of variable ellipsoid obclavate sub-oblong cylindrical sub-pyriform to oval irregularly pigmented 1-septate conidia with a septal constriction. A key to *Corynesporopsis* species is also presented.

Key words — systematics, anamorphic fungi

Introduction

Kirk (1981a) erected the genus *Corynesporopsis* for a single species, *C. quercicola* (Borowska) P.M. Kirk, previously placed in *Corynespora* Güssow. *Corynesporopsis* is characterized by terminal determinate (rarely with enteroblastic percurrent extensions) monotretic conidiogenous cells that produce cylindrical to ellipsoid euseptate catenate conidia that are borne through a slightly depressed and obvious apical pore of the conidiogenous cell.

During a survey of microfungi associated with plant debris collected in natural areas of Spain, a conspicuous fungus with morphological characteristics of *Corynesporopsis* was found. As the fungus shows significant differences from previously described taxa, we propose it as a new species.

Materials & methods

Individual samples of plant material collected during the survey were placed in paper and plastic bags, taken to the laboratory, and treated following the methods described

in Castañeda-Ruiz (2005) and Castañeda-Ruiz et al. (2010). Mounts were prepared in polyvinyl alcohol-glycerol (8 g in 100 ml of water, plus 5 ml of glycerol) and measurements under 1000× magnification. Micrographs were obtained with a Leitz Dialux 20. The holotype has been deposited in the Centraalbureau voor Schimmelcultures (CBS); other specimens are currently included among collections maintained by the Facultat Medicina de Reus (FMR), Reus, Spain.

Taxonomy

Corynesporopsis variabilis R.F. Castañeda, Hern.-Restr. & Gené, **sp. nov.**

MycoBank MB 802312 Figs 1, 2

Differs from other *Corynesporopsis* spp. by the variable shape and irregular pigmentation of its conidia.

Type – Spain, Castilla y León, Burgos, San Pedro de Arlanza, near to Monasterio de Arlanza (42°04′N 03°26′W, alt. 925 m), on decaying twig of unidentified plant, 11 November 2010, M. Hernández-Restrepo & J. Gené C10/136 (**Holotype**, CBS-H 20748; **Isotype**, FMR 11560).

Etymology: Latin, *variabilis*, referring to variation of conidial shape.

Colonies on the natural substrate effuse, hairy, dark brown to black. Mycelium immersed; hyphae septate, branched, cylindrical, 1–2 µm diam, smooth-walled, dark brown to brown. Conidiophores mononematous, macronematous, simple, erect, straight or slightly flexuous, cylindrical, 5–10-septate, smooth and thick-walled, 175–350 × 5–6 µm, dark brown below, brown towards the apex. Conidiogenous cells monotretic, terminal, cylindrical, determinate, brown, 12–29 × 3–4 µm, markedly thick-walled around the conidiogenous loci. Conidia variable ellipsoid, obclavate, sub-oblong, cylindrical, sub-pyriform to oval, 1-septate, slightly or strongly constricted and often darker pigmentation at the septum, irregularly pigmented, with dark brown or brown basal cell and pale brown apical cell, sometimes basal cell only slightly darker brown than the apical cell, clearly delimited by an obscure to black band around the septa, smooth-walled, 11–16 × 5–8 µm, dry, forming dark brown to black, acropetal, unbranched chains.

Additional specimen examined – Spain, Aragon, Huesca, Ordesa y Monte Perdido Nacional Park, Ordesa Valley, Arazas River (42°33′53.07″N 0°03′44.99″W, alt. 1048m), on submerged dead wood, 26 March 2011, M. Hernández-Restrepo & J. Capilla (FMR 12057).

Comments – *Corynesporopsis variabilis* slightly resembles *C. indica* and *C. inaequiseptata*. *Corynesporopsis indica* is easily distinguished by its ellipsoid to broadly obovoid (sometimes somewhat biconic) medially 1-septate larger [(14–)17–24(–27) × 8–12(–14) µm] uniformly dark brown to very dark brown conidia with a dark band at the septum (Kirk 1983, Ma et al. 2010); *C. inaequiseptata* differs by its longer (17–25 × 4–5.5 µm) narrowly obclavate asymmetrically 1-septate conidia with brown basal and pale brown apical cells

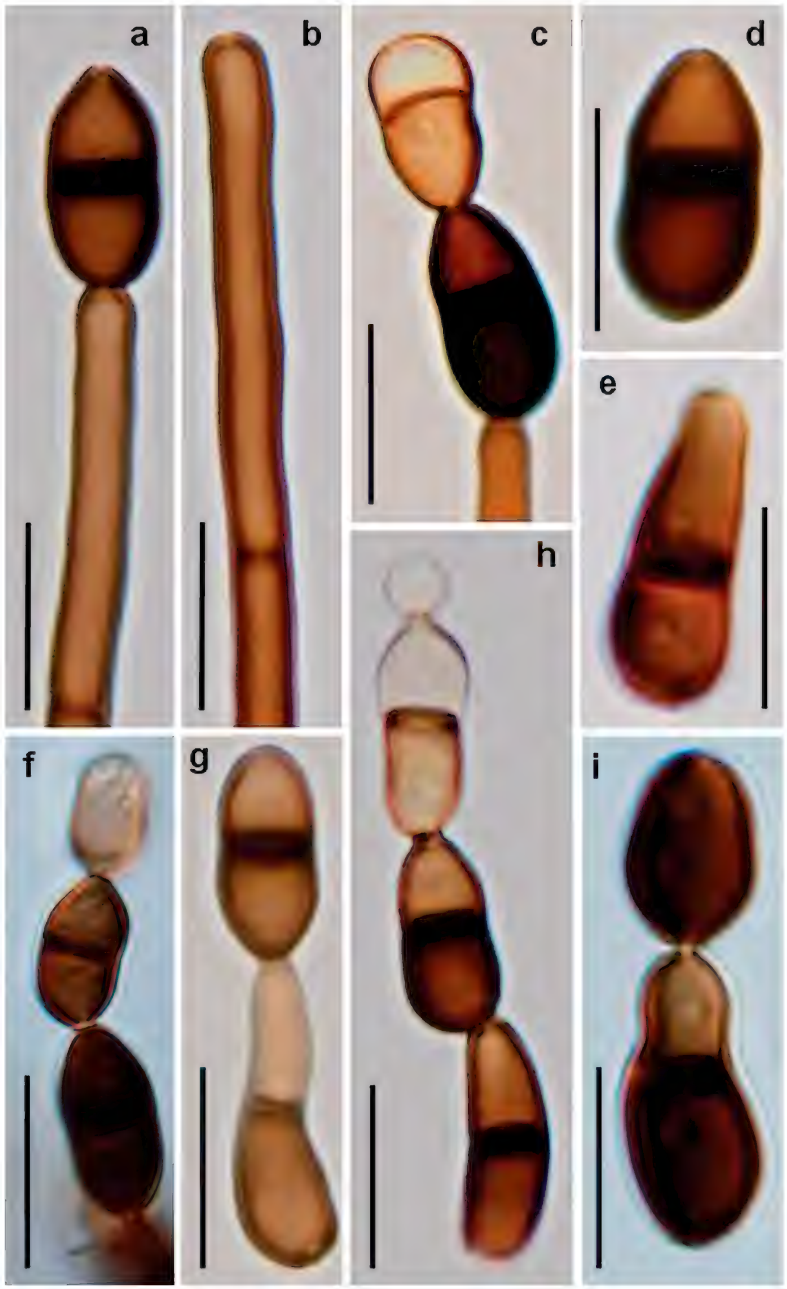

Fig. 1. *Corynesporopsis variabilis* (ex holotype CBS-H 20748): a-c. Conidiogenous cells and conidia. d-i. Conidia. Scale bar = 10 µm.

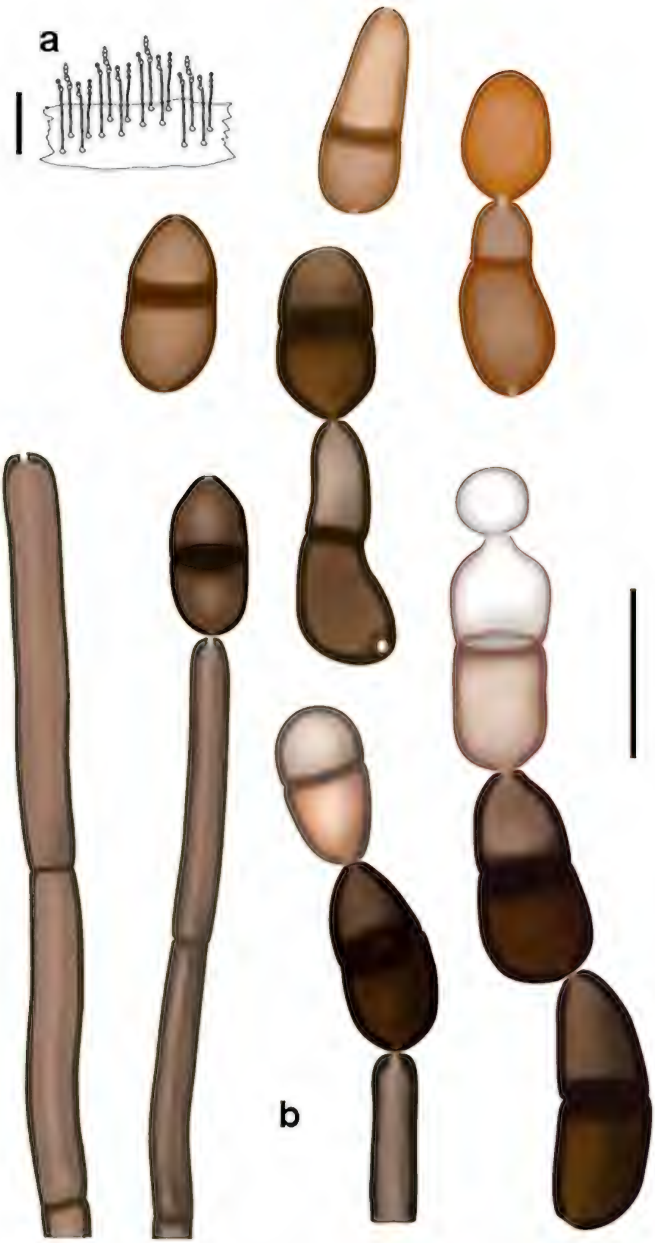

Fig. 2. *Corynesporopsis variabilis* (ex holotype CBS-H 20748): a. Colonies on the natural substratum. b. Conidiogenous cells and conidia. Scale bars: a = 100 µm; b = 10 µm.

(Matsushima 1993). Three other species with 1-septate conidia — *C. isabelicae* (Holubová-Jechová 1987), *C. liquidambaris* (Ma et al. 2012), *C. uniseptata* (Kirk 1981b) — obviously differ from *C. variabilis* in conidial shape and pigmentation.

Key to *Corynesporopsis* species

1 Conidia 1-septate, rarely 2-septate ..... *C. cylindrica*
[cylindrical, medium brown, guttulate, 12.5–20.5 × 6–7.5 µm]

Conidia strictly 1-septate 2

Conidia with more than 1 septum 5

2 Conidia elongate fusiform or navicular ..... *C. isabelicae*
[brown, with a thick dark brown septum, (24–)27–43.5 × 4–6.4 µm]

Conidia navicular to ellipsoid ..... *C. liquidambaris*
[brown to dark brown, with a thick dark brown septum,10–16.5 × 3.5–5.5 µm]

Conidia not elongate fusiform or navicular to ellipsoid 3

3 Conidia ellipsoid to broadly obovoid (sometimes somewhat biconic), not constricted at the septum ..... *C. indica*
[dark brown to very dark brown with a dark septal band, (14–)17–24(–27) × 8–12(–14) µm]

Conidia broadly ellipsoid, manifestly constricted at the septum .... *C. uniseptata*
[brown, often darker at the septum, 12–16 × 5–7 µm]

Conidia inequilateral or variable 4

4 Conidia 17–25 × 4–5.5 µm ..... *C. inaequiseptata*
[inequilateral, narrowly obclavate; basal cell dark brown, apical cell pale brown]

Conidia 11–16 × 5–8 µm ..... *C. variabilis*
[variable (ellipsoid, obclavate, sub-oblong, cylindrical, sub-pyriform to oval), irregularly pigmented, often constricted and darker at the septum]

5 Conidia usually with 2 septa 6

Conidia usually with more than 2 septa 7

6 Conidia (12–)14–18 × 6–8(–9) µm ..... *C. quercicola*
[broadly ellipsoid to cylindrical, end cells pale brown, middle cell dark brown]

Conidia 18–33 × 7–9 µm ..... *C. biseptata*
[cylindrical, straight or slightly curved, pale to mid-brown, central cell usually slightly longer than end cells]

7 Conidia 3–4(–5)-septate, 24–36 × 8–11 µm ..... *C. rionensis*
[fusiform, broadly fusiform or ellipsoidal, truncate at the ends, brown or dark brown, apical cell pale brown, septa dark and thick]

Conidia (3–)5(–6)-septate, 21–33 × 5–8 µm ..... *C. antillana*
[ellipsoidal, constricted at the septa, slightly truncate or rounded at the ends, 3–4 central cells dark brown, pale brown or colorless at the ends, septa black]

Conidia (2–)3–7-septate, 15–48(–59) × 3–4 µm ..... *C. iberica*
[cylindrical, sometimes slightly curved, rounded at the ends, dark brown, septa thick]

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Pholiota gallica nom. nov., based on *P. lubrica* var. *obscura*

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Abstract — The type of *Pholiota lubrica* var. *obscura*, a forgotten European fungus that has never been critically revised, was morphologically and molecularly examined. It was found to be phylogenetically distant from typical *P. lubrica* and morphologically distinct by its ovoid spores and other characters that place it in *Pholiota* sect. *Spumosae*. It differs from all other European species of sect. *Spumosae* by its unique combination of large fruitbody, castaneous brown pileus, stipe distinctively ornamented by scales or thick bands of bright yellow floccules, and growth on soil in thermophilous Mediterranean forests. For these reasons, we raise its rank to species as *Pholiota gallica* nom. nov., a replacement name required because the epithet *obscura* is already occupied in *Pholiota*. A discussion on similar European and North American species is included. *Pholiota virescentifolia* judged to be synonymous with *P. mixta*.

Key words — *Basidiomycota*, *Agaricales*, taxonomy, nomenclature, phylogeny

Introduction

Although several critical studies of the genus *Pholiota* in Europe have been published in last three decades (Jacobsson 1991, Holec 2001, Noordeloos 2011), there are still problems waiting for revision. One concerns *Pholiota lubrica* var. *obscura*, a fungus diagnosed by its robust stature, castaneous brown pileus, and stipe ornamented with big yellow floccules (Bon & Chevassut 1989). Holec (2001: 197) has been the only recent author to treat the variety. Its ovoid spores exclude this fungus from *P. lubrica* (diagnosed by phaseoliform spores in side view) and place it among species of *Pholiota* sect. *Spumosae*, characterised by ovoid spores. A detailed type study and comparison with similar taxa were necessary to evaluate taxonomic position of *Pholiota lubrica* var. *obscura*. The aim of this paper is to resolve the question using both morphological and molecular methods.

Table 1. Collections* used for DNA analysis.
(Collections sequenced for this paper are in bold.)

Collection	Country	Publication	DNA sequence	Voucher
P. castanea	USA	Matheny & Wolfenbarger, unpubl.	HQ222025	TENN020269
P. decussata	Italy	Osmundson et al. (2013)	JF908583	MCVE 11237 (paratype of *P. chocenensis*)
P. ferrugineo-lutescens	USA	Matheny & Wolfenbarger, unpubl.	HQ222026	TENN028897
P. gallica	**France**	**This paper**	**HG007988**	**MPU: Herbier Chevassut 3478** (holotype)
P. highlandensis	**Czech Rep.**	**This paper**	**HG007976**	**PRM 888152** (as *P. carbonaria*)
P. highlandensis	**Czech Rep.**	**This paper**	**HG007974**	**PRM 887239** (as *P. carbonaria*)
P. lenta	Italy	Osmundson et al. (2013)	JF908582	MCVE 7100
P. lenta	Finland	Guzmán-Dávalos et al. (2003)	AY281022	H, IBUG: R. Tuomikoski s.n.
P. lubrica	**Czech Rep.**	**This paper**	**HG007987**	**PRM 915546**
P. lubrica	**Czech Rep.**	**This paper**	**HG007986**	**PRM 899117**
P. lubrica	Japan?	Maeta et al. (2008)	AB301612	NBRC32453
P. mixta	**Czech Rep.**	**This paper**	**HG007979**	**PRM 909924**
P. spumosa	Italy	Osmundson et al. (2013)	JF908577	MCVE 3533
P. spumosa	**Czech Rep.**	**This paper**	**HG007983**	**PRM 897683**
P. spumosa	**Czech Rep.**	**This paper**	**HG007981**	**PRM 897147**
P. squarrosa	USA	Matheny et al. (2006)	DQ494683	PBM 2735 (also in CUW)
P. virescentifolia	USA	Matheny & Wolfenbarger, unpubl.	HQ222029	TENN020591

*Almost all available GenBank sequences from *Pholiota* sections *Spumosae* and *Lubricae* were included. Those omitted were: *P. mixta* EU715686 (Mexico; risk of misidentification); *P. flavida* JF908576 (Italy; identity unclear, as the name has been used in different senses); *P. lubrica* JF 908578 (Italy; = *P. lenta*, according to DNA data); and *P. spumosa* AY781268, AY618246, and *P. carbonaria* JF440578, GU934596, AY251301 (environmental samples not based on critically identified vouchers).

Materials & methods

Morphology

The holotype of *P. lubrica* var. *obscura* was loaned to the first author directly from G. Chevassut in 2002. After Chevassut's unfortunate death in 2003, the holotype was retained in PRM herbarium (Mycological Department, National Museum, Prague, Czech Republic) as it was unclear whom to return it. In 2013 it was sent to MPU herbarium (Institut de Botanique, Université Montpellier 2, France), the current 'home' of Chevassut's herbarium. (For herbarium acronyms, see Thiers 2013.) The type was studied by traditional taxonomic methods as set forth in Singer (1986), Bas et al. (1988), and Holec (2009). Microscopic mounts were made in a 5% KOH solution and studied

under an Olympus BH-2 light microscope. Spore sizes are presented as the main data range (c. 10–90 percentile values) flanked by extreme values (in parentheses) of all spores measured (20 measurements per collection). The spores were measured directly in the microscope using the eyepiece micrometer. Q = the length/width quotient of all spores and Qav = mean value of Q.

Phylogeny

DNA was isolated from dried specimens as described in Holec & Kolařík (2013). The ITS-LSU rDNA gene was amplified using primers ITS1F and LR6; the same primers, together with primers ITS4 and NL1, were used for sequencing. Sequences were combined with published *Pholiota* ITS-LSU rDNA sequences (Tab. 1) selected from GenBank based on the greatest similarity using BLAST search and subsequent phylogenetic analysis (trees not shown). The dataset was aligned in MAFFT v6.861b (Katoh & Toh 2008). *Pholiota squarrosa* (Vahl) P. Kumm., a taxon sister to our sequences in the preliminary tree, was selected as outgroup. Of the total 17 sequences (eight obtained in this study) and 693 positions in the final dataset, 132 were variable and 91 parsimony informative. The evolutionary history was inferred by the Maximum Parsimony method in MEGA 5.0 (Tamura et al. 2011) using default settings and 300 bootstrap replicates. Bayesian phylogenetic analyses were conducted as described in Holec & Kolařík (2013) using a K2H-I substitution model.

Taxonomy

Morphology

Our holotype study (see below) confirmed the original observation by Bon & Chevassut (1989) that *P. lubrica* var. *obscura* has ellipsoid-ovoid to ovoid spores. For this reason it cannot belong to *P. lubrica* (Pers.) Singer, which is characterized by phaseoliform spores in side view (Holec 2001). *Pholiota lubrica* is the type species of *Pholiota* sect. *Lubricae* (Fr.) Singer (emend. Holec 2001) that is delimited by phaseoliform spores and comprises three European species: *P. lubrica*, *P. lenta* (Pers.) Singer, and *P. elegans* Jacobsson. [Jacobsson (1991) and Noordeloos (2011) used the name *P.* sect. *Lubricula* Kühner, a synonym of *P.* sect. *Lubricae*.]

Its ovoid spores place *P. lubrica* var. *obscura* in *Pholiota* sect. *Spumosae* A.H. Sm. & Hesler (emend. Jacobsson 1991), represented in Europe by *P. spumosa* (Fr.) Singer, *P. mixta, P. highlandensis* (Peck) Quadr. & Lunghini, *P. brunnescens* A.H. Sm. & Hesler, and *P. chocenensis* Holec & Kolařík (Holec 2001, Holec et al. 2014, Noordeloos 2011). These species are very similar microscopically and are delimited based on mostly macromorphological and ecological characters.

Pholiota lubrica var. *obscura* differs from all species of sect. *Spumosae* by its unique combination of characters: large fruitbodies, castaneous brown pileus, stipe distinctively ornamented by scales or thick bands of bright yellow floccules, and growth on soil (not on burnt wood, charcoal, or ash) in thermophilous Mediterranean forests.

Phylogeny

Our sequence analyses of representatives of sects. *Spumosae* and *Lubricae* support the conclusions of our morphological analyses. The phylogenetic tree (Plate 1) placed with high statistical support the sequences of *P. lubrica* var. *obscura* and the typical *P. lubrica* on very distant clades. The *P. lubrica* var. *obscura* sequence comprises 698 readable positions and a string of 57 positions in ITS2 that are superimposed, even in repeated sequencing of independently amplified PCR amplicons. This sequence, when aligned with *P. lubrica* (536 positions), differs in 11% of the positions.

Pholiota lubrica var. *obscura* forms a strongly supported lineage with *P. highlandensis* (sect. *Spumosae*) and two GenBank entries (*P. castanea, P. decussata*). However, both the American *P. castanea* and an Italian collection identified as *P. decussata* (Osmundson et al. 2013) form a separate clade. The sequence of *P. decussata* sensu Osmundson et al., which represents *P. chocenensis*

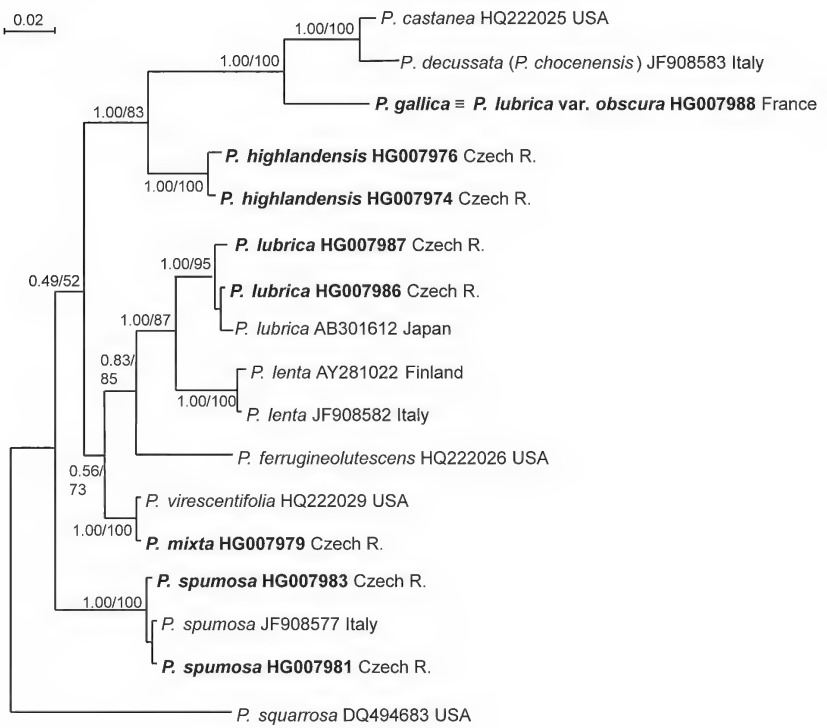

Plate 1. Phylogenetic placement of *Pholiota gallica* inferred from ITS rDNA data. MrBayes tree topology is presented; numbers beside the nodes represent Bayesian MCMC posterior probabilities and parsimony bootstraps. Sequences printed in bold were obtained during this study.

(Holec et al. 2014), differs from that of *P. lubrica* var. *obscura* by 18%. The species traditionally classified in sect. *Lubricae* — *P. lubrica*, *P. lenta*, and the American *P. ferrugineolutescens* — form a second well-supported lineage. Other members of sect. *Spumosae*, *P. mixta* (European)/*P. virescentifolia* (American) and *P. spumosa*, form two independent phylogenetic lineages. The mutual positions of these four main species groups are unresolved. Our data suggest that species of the traditionally recognized sect. *Spumosae* form several well-supported lineages related to the species lineage from sect. *Lubricae*. Thus, sect. *Spumosae* appears paraphyletic and contains some *Lubricae* species. Broader taxon sampling and additional molecular markers are needed to determine if both sections represent natural monophyletic groups or if the higher ranked taxon – *Pholiota* subgen. *Flammuloides* A.H. Sm. & Hesler (= *P.* subgen. *Lubricula* Kühner) – is the monophyletic group containing all the species mentioned.

Taxonomic position of *P. lubrica* var. *obscura*

The most important conclusions from our morphological and DNA analyses are that (1) *P. lubrica* var. *obscura* is clearly distant from the typical *P. lubrica*, (2). *P. lubrica* var. *obscura* is also distant from other European representatives of *Pholiota* sects. *Spumosae* and *Lubricae* as well as from its nearest relatives in the *P. highlandensis* clade, and (3) *P. lubrica* var. *obscura* is separated by a unique combination of morphological and ecological characters. For these reasons, it is raised to species rank below.

Pholiota gallica Holec & Kolařík, **nom. nov.** PLATE 2

MYCOBANK: MB804715

ETYMOLOGY: from *Gallia*, the Latin name for today's France, the type locality.

≡ *Pholiota lubrica* var. *obscura* Bon & Chevassut, Doc. Mycol. 19(75): 44. 1989. [non *Pholiota obscura* A.H. Sm. & Hesler, N. Amer. Species *Pholiota*: 108. 1968].

TYPE: France, Languedoc, Maison forestière des Plots, 350 m a.s.l., under *Pinus halepensis*, 24.XI.1985, leg. Durand, herb. G. Chevassut no. 3478 (holotype, MPU!; GenBank HG007988, as P. *lubrica* var. *obscura*); 10 km N of Montpellier, Bellevue, under *Quercus ilex*, 24.XI.1968, herb. G. Chevassut no. 600 (paratype, MPU; not seen; loan request not acknowledged).

ORIGINAL DIAGNOSIS (Bon & Chevassut 1989): *A typo differt pilei coloribus obscurioribus (brunneis ad instar* Suilli lutei*), stipite conspicue luteo-armillato, lamellis sporisque fuscioribus quam in typo. Micro sicut in typo sed sporae interdum usque ad 8(8.5) × 5–5.5 µm, pariete s.l. +/- brunneola.*

ORIGINAL LINE DRAWINGS: Doc. Mycol. 19(75): p. 43, fig. 25, 1989.

ENGLISH TRANSLATION OF THE ORIGINAL FRENCH DESCRIPTION — A large *Pholiota*, with castaneous brown pileus and stipe ornamented with big yellow floccules. PILEUS 4–9 cm, cuticle viscid, bright brown (like *Suillus luteus*); LAMELLAE rather broad (≤1 cm), rather dense, emarginate, pale olivaceous yellow or somewhat darker; STIPE 3–7 × 1–1.2 cm, subcylindrical, distinctively

ornamented (starting several cm under the lamellae) by bright yellow floccules which are very characteristic (scales or thick bands); CONTEXT thick, white, odour weak, of leather. SPORES 5.5–7.5(–8.5) × (4.5–)5–5.5 µm, ovoid with an indistinct germ pore and wall rather dark for a *Pholiota* s.str.; CYSTIDIA variable, clavate, ventricose or lageniform, 40–60 × 12–15 µm, ± yellow on apex in ammonia but only slightly cyanophilous in C4B; CHEILOCYSTIDIA of the same type but ± intermixed with marginal cells of variable shape, clavate, fusiform or lageniform and ± constricted, hyaline; EPICUTIS a remarkably gelatinized ixotrichoderm, hyphae 2–5 µm; PIGMENT of several types (mixed) or membranally encrusting towards the subcutis; CLAMPS numerous.

Holotype study

The holotype consists of two well-dried mature fruitbodies. BASIDIOSPORES 6.8–8 × 4.4–4.8(–5.2) µm, Q = 1.38–1.73, Qav = 1.55, ellipsoid-ovoid to ovoid in face view, ovoid in side view, rusty yellow, wall thick, rusty brown, with a narrow but distinct germ pore, hilar appendix indistinct; BASIDIA 24–27 × 6–7 µm, 4-spored, narrowly clavate with median constriction; BASIDIOLAE 16–20 × 6–7 µm, clavate; LAMELLAE EDGE fertile; CHEILOCYSTIDIA numerous, protruding, 42–56 × 10–12 µm, fusiform to lageniform with narrow pedicel (1.5–3 µm), thin-walled, sometimes with apical yellow incrustations, mostly hyaline or some partly filled with a homogeneous pale yellow content or completely filled with a fine granular rusty yellow substance; PLEUROCYSTIDIA abundant, 56–60 × 12–16 µm, similar to cheilocystidia; CHRYSOCYSTIDIA absent; LAMELLAR TRAMA regular, of parallel hyphae 2–10 µm broad; PILEUS CUTICLE formed by a thin rusty brown epicutis and a thicker rusty yellow subcutis, gradually passing into the pileus trama, non-gelatinized; EPICUTIS of cylindrical hyphae 3–10 µm broad, with strong membranal and encrusting pigmentation; SUBCUTIS of hyphae 10–24 µm broad, formed by cylindrical to slightly fusiformly inflated, thick-walled cells with membranal and encrusting pigmentation, when observed on sections which are not parallel with subcutis hyphae, the subcutis looks subcylindrical, of ellipsoid to subglobose cells, however, these "cells" represent oblique sections through cylindrical hyphae; PILEOCYSTIDIA or distinctively shaped terminal elements absent; STIPE CUTICLE a cutis of densely arranged cylindrical hyphae, (2–)4–10 µm broad, with yellow membranal pigment and yellow-rusty encrustations, covered with cords of more distinctively pigmented hyphae forming the stipe covering, at places forming interwoven and protruding clumps (visible as scales by naked eye) of hyphae 4–12 µm broad; CAULOCYSTIDIA or distinctively formed terminal elements absent; CLAMP CONNECTIONS present in all tissues.

Taxonomic notes

Our morphological observations were very similar to those by Bon & Chevassut (1989). The discrepancies concern the cystidial shape (we did

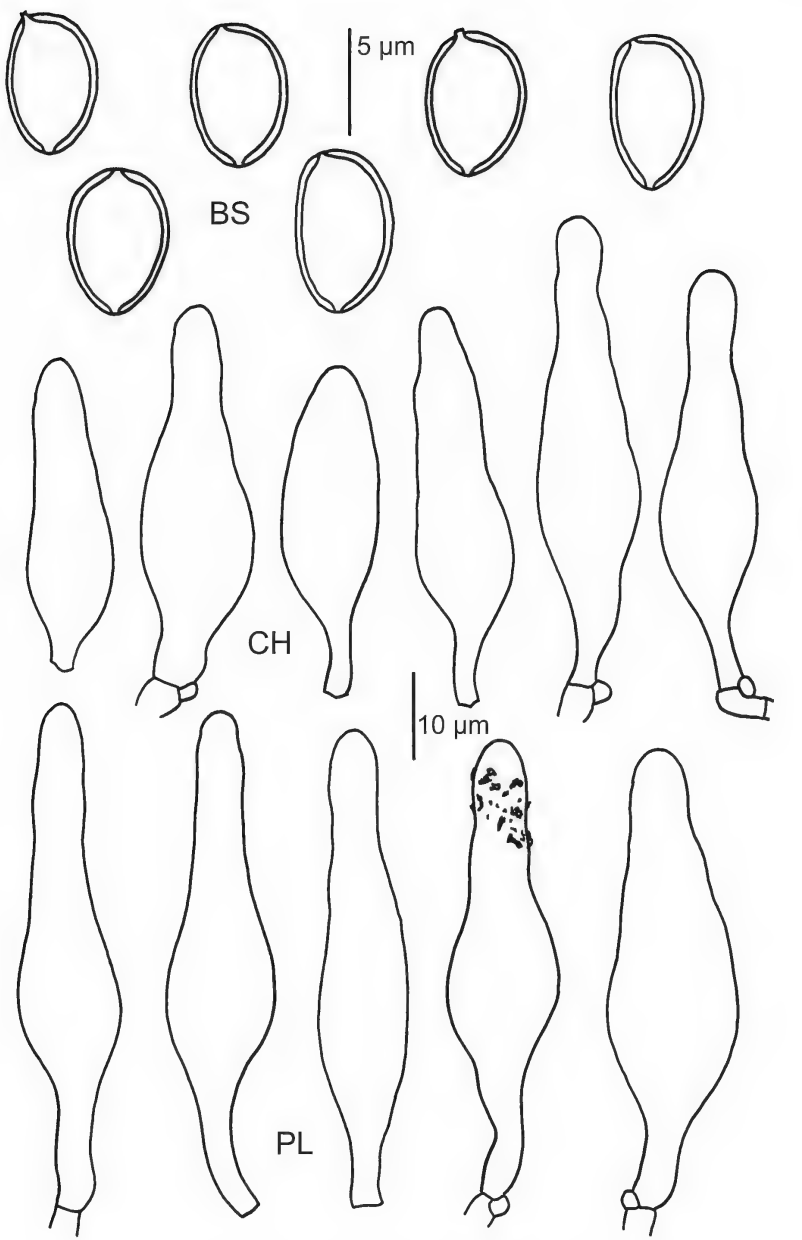

Plate 2. *Pholiota gallica* (holotype, MPU: herb. G. Chevassut no. 3478).
BS: basidiospores, CH: cheilocystidia, PL: pleurocystidia. Drawing by J. Holec.

not observe clavate cystidia) and the character of the pileus cuticle, which was certainly in more natural condition when studied by Bon & Chevassut, who observed an ixotrichoderm that probably collapsed when dried and so resembled the cutis seen by us. The most important *P. gallica* characters are the ovoid spores with a narrow germ pore, numerous fusiform to lageniform cheilo- and pleurocystidia (sometimes with a yellow apex or yellow intracellular pigmentation), and the absence of pileo-/caulocystidia or distinct terminal elements. These characters place *P. gallica* in *Pholiota* sect. *Spumosae*.

Although only two *P. gallica* collections are currently available, the uniqueness and correlation of the morphological, ecological, and DNA characters support the elevation of the original variety to species rank. The taxonomic resolution, awaited for 12 years by the first author (see Holec 2001: 197), was finally powered by our phylogenetic results. We would like to direct the attention of Mediterranean mycologists to *P. gallica* so as to stimulate their search for it. We believe that we offer a better solution than ignoring the forgotten *P. lubrica* var. *obscura,* which, moreover, does not represent the typical *P. lubrica*.

Comment on nomenclature: We intended to raise *P. lubrica* var. *obscura* to the rank of species using the name 'obscura.' However, the previous existence of *P. obscura* A.H. Sm. & Hesler required that we create a replacement name (*P. gallica*) for the species, which shares the holotype of *P. lubrica* var. *obscura*.

Notes on similar European species

We summarize the morphological differences between *P. gallica* and the European species of *Pholiota* sects. *Spumosae* and *Lubricae* in Tab. 2. The species most similar in habit are *P. chocenensis*, *P. brunnescens,* and *P. lubrica*. However, *P. chocenensis* is smaller and has a brighter pileus colour and darker stipe covering, *P. brunnescens* grows on coal and has caulocystidia on the stipe surface (Holec et al. 2014 show that it is probably conspecific with *P. highlandensis*), and *P. lubrica* has slightly phaseoliform spores. *Pholiota gallica* seems to be a Mediterranean species growing under typical thermophilous trees (*Pinus halepensis*, *Quercus ilex*), but further collections are needed to evaluate its habitat preferences more precisely.

Notes on American species

In their North American *Pholiota* monograph, Smith & Hesler (1968) treated many species in *Pholiota* sects. *Flammuloides*, *Carbonicola*, *Spumosae*, and *Lubricae* based on microcharacters that are simultaneously very similar and very variable. Molecular studies would be helpful, but *Pholiota gallica* does not match any of the small percentage of taxa already sequenced (Plate 1).

The morphologically most similar species belong to stirpes *Condensa* and *Spumosa* (Smith & Hesler 1968), neither of which fits *P. gallica*. Within sect. *Lubricae* sensu Smith & Hesler (differently circumscribed than our section *Lubricae*), the most similar taxa are in stirpes *Fibrillosipes* and *Lubrica*. The

Table 2. Pairwise comparisons of characters differentiating *P. gallica* from other European species of *Pholiota* sect. *Spumosae* and *Lubricae**

Taxon	Taxon characters	*P. gallica* characters
P.* sect. *Spumosae	**Spores ovoid**	
P. chocenensis	Rather small (pileus 1.5–5 cm), pileus bright (orange, with yellow-ochre or rusty brown tinge), stipe veil remnants dark (yellow-rusty to rusty orange)	Large (pileus 4–9 cm), pileus dark (castaneous brown), stipe veil remnants yellow
P. highlandensis	Anthracophilous; stipe covering fine, flocculose to fibrillose	Terricolous; stipe covering distinct, forming scales to bands
P. mixta	Rather small (pileus 2–6 cm), pileus margin and stipe whitish, stipe covering fine, fibrillose	Large (pileus 4–9 cm), pileus dark (castaneous brown); stipe covering distinct, forming scales to bands
P. spumosa	Medium-sized (pileus 3–7 cm), yellow-ochre to yellow–brown; stipe covering fine, fibrillose-tomentose	Large (pileus 4–9 cm), pileus dark (castaneous brown); stipe covering distinct, forming scales to bands
P. brunnescens	Anthracophilous; caulocystidia clavate	Terricolous; caulocystidia absent
P.* sect. *Lubricae	**Spores phaseoliform in side view**	
P. lubrica	Pileus orange, cinnamon to reddish-brown with paler margin; spores phaseoliform in side view	Pileus castaneous brown; spores ovoid
P. lenta	Pileus whitish to greyish-beige; spores phaseoliform in side view	Pileus dark (castaneous brown); spores ovoid
P. elegans	Pileus lemon-yellow, yellow to yellow-ochre; spores phaseoliform in side view	Pileus dark (castaneous brown); spores ovoid

*Based on data in this paper, Holec (2001), Noordeloos (2011), and (for *P. chocenensis*) Holec et al. (2014).

species there differ from *P. gallica* in macrocharacters and smaller, more or less phaseoliform basidiospores. However, a final conclusion must await the revision and sequencing of all North American species.

Identity of *P. virescentifolia*

Pholiota mixta (Fr.) Kuyper & Tjall.-Beuk., Persoonia 13: 81. 1986.

≡ *Agaricus mixtus* Fr., Epicr. Syst. Mycol.: 185. 1838.

= *Pholiota virescentifolia* A.H. Sm. & Hesler, N. Amer. Species Pholiota: 363. 1968.

The sequence obtained from the holotype of *P. virescentifolia* forms a strongly supported lineage with the European *P. mixta* (Plate 1). Their morphological characters agree as well, except for tufts of caulocystidia that Holec (2001) did not observe in *P. mixta*. However, the key diagnostic characters are the same in both species: dirty yellow-brown viscid pileus, short stipe with whitish apex, ovoid spores measuring about 5.5–8 × 3.5–4 µm, numerous and large cheilo- and pleurocystidia, and growth on soil and humus (not on wood). We therefore place *P. virescentifolia* into synonymy under *P. mixta*.

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Corymbiglomus pacificum, a new glomeromycete from a saline lakeshore in Chile

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Abstract — A new species of the *Glomeromycetes* is diagnosed by bright yellow to dark yellow bi-walled spores (85–131 µm diam.) that form terminally on cylindrical subtending hyphae. The yellow outer spore wall is continuous with the hyphal wall, while the germ tubes emerge during germination from the hyaline inner wall to penetrate the outer wall. Phylogenetic analyses place the new fungus, *Corymbiglomus pacificum*, within the *Diversisporales* next to *C. corymbiforme* and *C. globiferum*. The new species was found in the Araucanía region of southern Chile in the rhizospheric soils of *Ammophila arenaria* at the mouth of Lake Budi, a saline ecosystem where the lake is periodically directly connected to the Pacific Ocean.

Key words — *Glomeromycota*, *Diversisporaceae*, molecular phylogeny, arbuscular mycorrhizal fungi

Introduction

Budi Lake is an unusual coastal lake in La Araucanía Region of southern Chile. When the lake water levels rise after high winter rainfalls or during exceptionally high tides, the lake connects with the Pacific Ocean, while it is

rarely connected during the summers (Peña-Cortés et al. 2006). During high tides, ocean water enters the lake, giving it a brackish nature (1.5–2.0% salt; Basualto et al. 2006).

Ammophila arenaria (L.) Link *(Poaceae)* is one of the dominant pioneer plant species growing on the alluvial-stony lakeshore at the mouth of Budi Lake. This plant, which is distributed worldwide, is often called European beach or European marram grass due to its dominance of many saline dunes in Europe and North Africa. *Ammophila arenaria,* which has high sand burial tolerance, promotes dune formation through sand accumulation. Arbuscular mycorrhizal (AM) fungi are important components for stabilizing such ecosystems through soil aggregation and formation of extensive extraradical mycelial networks. Previous studies have shown that a number of AM fungal species belonging to several genera (e.g., *Acaulospora*, *Diversispora*, *Funneliformis*, *Glomus*, *Racocetra*, and *Scutellospora*) are associated with *A. arenaria* (Błaszkowski 1994; Kowalchuk et al. 2002; Rodríguez-Echeverría & Freitas 2006; Estrada et al. 2011, 2013).

During diversity studies of AM fungi at Budi Lake, an undescribed species was found in the rhizospheric soils of *A. arenaria*. The objective of the present study was to thoroughly investigate the new fungal species through combined morphological and molecular spore analyses and describe the fungus accordingly.

Materials & methods

Study site and soil sampling

Lake Budi (approximately 56 km^2) is located on the Pacific coastline of the municipality Puerto Saavedra in La Araucanía Region (southern Chile, 38°53′S 73°17′W). Its typical Pacific seaside climate has a narrow temperature range (annual average temperature of 12°C) due to the marine and lacustrine thermoregulation effect; summer maximum and minimum temperatures average 18–20°C and 9–11°C, while winter averages are 13–14°C and 0.5–7°C. The annual average rainfall, concentrated between autumn (March) and early spring (August), is 1350 mm (Peña-Cortés 2008).

Several pioneer species (e.g., *Ammophila arenaria*, *Ambrosia chamissonis* (Less.) Greene, *Polygonum maritimum* L., and *Carpobrotus chilensis* (Molina) N.E. Br.) grow in the lake–ocean transition zone (38°49′34″S 73°23′43″W). Rhizospheric soil was collected from these plant species in 2011 (April, July, October) and 2012 (January). The new fungus was found in *A. arenaria* rhizospheric soils, which were air-dried and stored for AM fungal spore isolation and identification. The soils had a pH (H_2O) 8.1, 15 mg kg^{-1} organic carbon, 4.0 mg kg^{-1} available P (as 'Olson'-P), 74.0 mg kg^{-1} available K (as 'ammonium-acetate'-extractable K), and 350.3 mS m^{-1} electrical conductivity.

AM fungal bait cultures

Although bait cultures were established as described in Oehl et al. (2012), no spores have yet been produced by the new fungus.

Morphological analyses

AM fungal spores were separated from the soil samples by a combined wet sieving and specific density/sugar-gradient separation process as described by Sieverding (1991). Spore morphology and subcellular structures were described based on observations of specimens mounted in polyvinyl alcohol-lactic acid-glycerol (PVLG; Koske & Tessier 1983), a mixture of PVLG and Melzer's reagent (Brundrett et al. 1994), a mixture of lactic acid and water at 1:1, Melzer's reagent, and water (Spain 1990). Spore terminology follows that presented for species with glomoid, pacisporoid, diversisporoid or paraglomoid spore formation in Oehl et al. (2005, 2011a) and Mello et al. (2013). Photographs were taken with a digital camera (Leica DFC 290) on a compound microscope (Leitz Laborlux S) using Leica Application Suite Version V 2.5.0 R1 software. Specimens mounted in PVLG and the mixture of PVLG and Melzer's reagent were deposited at the mycological herbaria of ETH Zurich (Z+ZT, Switzerland), of the University of Granada (GDA-GDAC, Spain) and of the Federal University of Pernambuco (URM, Recife, Brazil).

Molecular and phylogenetic analyses

After all isolated spores were washed in ultrapure water and sonicated three to four times, crude DNA extracts were obtained from two single spores, extracted from field soil samples taken at the type location in January 2012. The spores were singly placed on a slide in a drop (5–10 µL) of ultrapure water and crushed with a sterile needle. Extracted DNA was used as template for a semi-nested PCR using the primers ITS3+28G2 (White et al. 1990; Silva et al. 2006) and LR1+28G2 (van Tuinen et al. 1998; Silva et al. 2006), consecutively. PCR reactions were carried out in a volume of 50 µL, containing 75 mM Tris-HCl pH 8.8, 200 mM $(NH_4)_2SO_4$, 0.01% Tween 20, 2 mM $MgCl_2$, 200 µM each dNTPs, 1µM of each primer and 2 units of Taq™ DNA polymerase (Fermentas, Maryland, USA); cycling parameters were 5 min at 95 °C (1 cycle), 45s at 94 °C, 1 min at 55 °C, 1 min at 72 °C (40 cycles), and a final elongation of 7 min at 72 °C followed the last cycle. The final amplicons (~690 bp) were purified with the PureLink PCR Purification Kit (Invitrogen™, Carlsbad, USA), sequenced directly or cloned with a CloneJET™ PCR Cloning kit (Fermentas; Carlsbad, USA) following the manufacturer's instructions and sequenced. Sequencing was provided by the Human Genome Research Center (São Paulo, Brazil). Sequence data were compared to public databases (EMBL and GenBank) using BLASTn. The new sequences were deposited in the NCBI database under the accession numbers HG532010–HG532015.

The phylogeny was reconstructed by analyses of the partial LSU rDNA. The AM fungal sequences were aligned in ClustalX (Larkin et al. 2007) and edited with the BioEdit program (Hall 1999) to obtain a final alignment. *Pacispora scintillans* (S.L. Rose & Trappe) Sieverd. & Oehl ex C. Walker et al. was included as outgroup. Prior to phylogenetic analysis, the model of nucleotide substitution was estimated using Topali 2.5 (Milne et al. 2004). Bayesian (two runs over 1×10^6 generations with a burnin value of 2500) and maximum likelihood (1000 bootstrap) analyses were performed, respectively, in MrBayes 3.1.2 (Ronquist & Huelsenbeck 2003) and PhyML (Guindon & Gascuel 2003), launched from Topali 2.5, using the GTR + G model. Neighbor-joining (established with the model cited above) and maximum parsimony analyses were performed using PAUP*4b10 (Swofford 2003) with 1000 bootstrap replications.

Results

Taxonomic analyses

Corymbiglomus pacificum Oehl, J. Medina, P. Cornejo, Sánchez-Castro, G.A. Silva & Palenz., **sp. nov.** FIGS 1–8

MYCOBANK MB 805601

Differs from other *Corymbiglomus* species by the lack of a hyphal mantle.

TYPE: Chile, La Araucanía Region, Puerto Saavedra (38°49′34″S 73°23′43″W); isolated from the rhizospheric soil of *Ammophila arenaria* at the Budi Lake in close proximity to the Pacific Ocean, 36-3601 (**holotype**, ZT Myc 49005); 36-3602–36-3610 (**isotypes**, ZT Myc 49006); 36-3621 (**isotype**, URM 83531).

ETYMOLOGY: *pacificum* (Latin), referring to the Pacific Ocean, which is adjacent to the isolation site.

SPOROCARPS unknown.

SPORES formed singly in soil, bright yellow to dark yellow to rarely brownish yellow, globose to subglobose to rarely ellipsoid to irregular, (85–)95–130 (–135) × (75–)85–125(–131) µm diam., with outer and inner walls.

OUTER WALL smooth, three-layered: outer layer (OWL1) evanescent to semi-persistent, subhyaline to light yellow, 0.6–1.2 µm thick, usually tightly adherent to second layer (OWL2); OWL2 finely laminated, bright yellow to dark yellow to brownish dark yellow, 1.8–3.5(–4.5) µm; inner layer (OWL3) hyaline, thin (0.4–0.7 µm), separable under pressure but usually adherent to OWL2 and then difficult to observe. Outer spore surface partially expands slightly and thus sometimes appears lamellate to slightly pustulate.

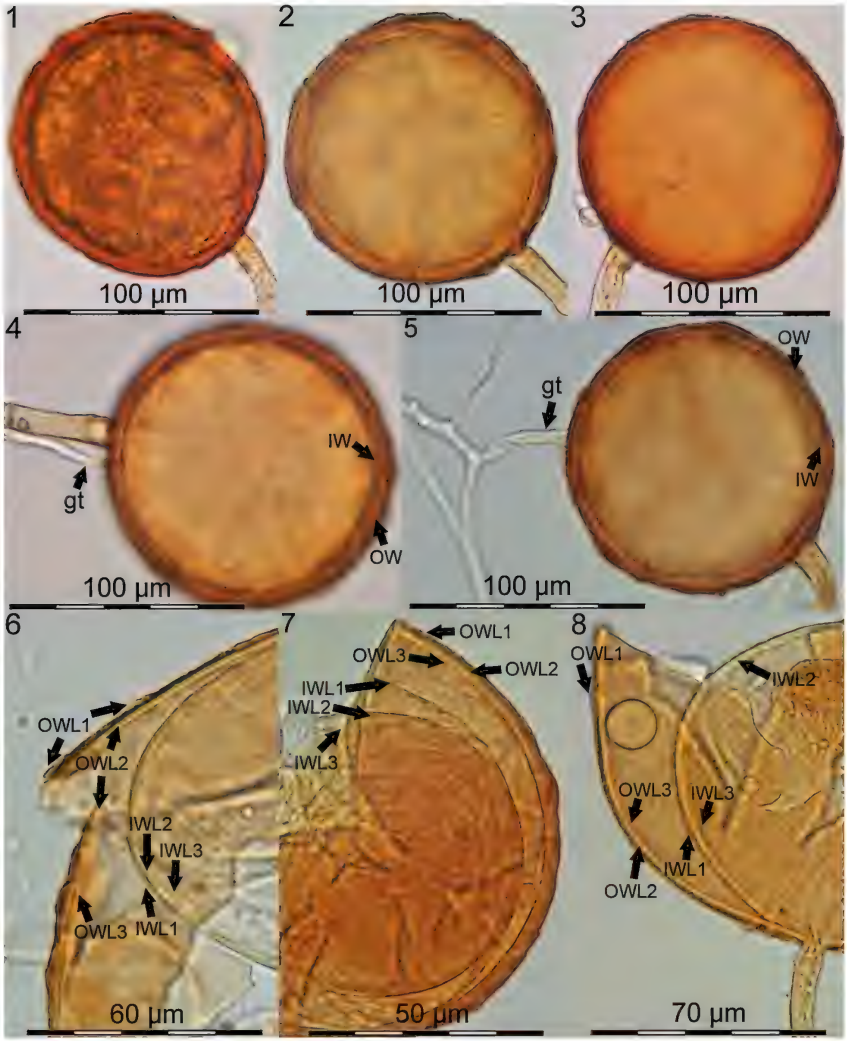
INNER WALL hyaline, three-layered: outer layer (IWL1) 0.4–1.0 µm thick (in crushed spores sometimes separating under light pressure from IWL2); central layer (IWL2) 1.5–2.5(–3.0) µm thick; inner layer (IWL3) very thin (0.4–0.7 µm), flexible, showing folds in broken spores, usually adhering to IWL2 and often difficult to observe. IWL2 may stain light yellow to bright dark yellow in Melzer's reagent.

SUBTENDING HYPHA usually straight (sometimes recurved), 7–12 µm diam. at the spore base, cylindrical (rarely slightly constricted); wall concolorous and continuous with OWL1 and OWL2 and of the same thickness up to (5–)10–25 µm from the spore base, where it tapers to <0.5 µm within 60–120 µm; pore often closed at the spore base by a septal bridge formed by OWL2 and the adherent OWL3, the pore sometimes apparently open, and with the IW that forms de novo during spore formation closing the pore at the spore base.

GERMINATION occurring directly through the outer spore wall after a single germ tube emerges on the outer surface of the inner wall.

MYCORRHIZA FORMATION unknown.

DISTRIBUTION: The new fungal species is restricted thus far to the on the ocean side of Budi Lake in the rhizospheric soil of *Ammophila arenaria.*



Figs 1–8. *Corymbiglomus pacificum*. **1–5**. Uncrushed spores with two walls: outer and inner wall (OW and IW); pigmented subtending hyphae cylindrical to slightly constricted; hyaline germ tubes (gt) penetrating OW; spore surface with rough, lamellate to slightly pustulate appearance due to partial expansion of the outermost wall layer. **6–8**. Crushed spores with triple-layered OW and triple-layered IW (OWL1-3 and IWL1-3); OWL1 evanescent and with lamellate to pustulate appearance; OWL2 laminate (Fig. 7), and IWL2 staining yellow in Melzer's reagent (Fig. 8).

Associated species of *Glomeromycetes* Caval.-Sm. (Oehl et al. 2011c) at the site included *Acaulospora scrobiculata* Trappe, *Glomus macrocarpum* Tul & C. Tul., and *Septoglomus constrictum* (Trappe) Sieverd. et al.

Molecular analyses

Phylogenetic analyses of the partial LSU rRNA sequences place *C. pacificum* into the /corymbiforme clade near *C. globiferum* and *C. corymbiforme* and support *Corymbiglomus* with high bootstrap and posterior probabilities values (Fig. 9). The intra-specific variation between LSU rRNA gene sequences for the new species was around 1%. In the BLASTn analysis, the species most closely related to *C. pacificum* was *C. globiferum* with a 96% similarity. Environmental sequences most similar to the new species sequences (97%) were found in roots of *Ixeris repens* (*Asteraceae*) collected from saline coastal beach vegetation in Japan (Yamato et al. 2012).

Discussion

Corymbiglomus pacificum can easily be distinguished morphologically from all other species in the *Glomeromycota* through the combination of spore formation type, spore color, and spore wall structure. The three genera producing bi-walled spores terminally on subtending hyphae are *Pacispora* Sieverd. & Oehl (Oehl & Sieverding 2004), *Corymbiglomus* Błaszk. & Chwat (Błaszkowski 2012, Błaszkowski & Chwat 2013), and some species of *Paraglomus* J.B. Morton & D. Redecker (Morton & Redecker 2001, Oehl et al. 2011b, Mello et al. 2013). However, *Pacispora* species form typically pacisporoid hyphal connections, often with one to multiple hyphal pegs on constricted subtending hyphae, and their inner walls stain purple to dark purple in Melzer's reagent, not found in *Corymbiglomus*. In *Paraglomus*, only one species forms pigmented spores, *P. bolivianum* (Sieverd. & Oehl) Oehl & G.A. Silva (Oehl & Sieverd. 2004, Mello et al. 2013), which have a pitted spore surface.

The three species previously described in *Corymbiglomus* are *C. corymbiforme* (Błaszk.) Błaszk. & Chwat, *C. globiferum* (Koske et C. Walker) Błaszk. & Chwat, and *C. tortuosum* (N.C. Schenck & G.S. Sm.) Błaszk. & Chwat (Błaszkowski 2012, Błaszkowski & Chwat 2013, Błaszkowski 1990, 1995, Koske & Walker 1986, Schenck & Smith 1982). All three are characterized by spores that are individually covered with a hyphal mantle of non-branched or branched hyphae with or without terminal vesiculate swellings (Błaszkowski & Chwat 2013). As the spores of *C. pacificum* are smooth and lack a hyphal mantle, the generic description of *Corymbiglomus* may need emending.

Corymbiglomus pacificum (characterized by yellow spores lacking a peridium) is phylogenetically most closely related to *C. globiferum*, which differs morphologically in its orange-brown to 'rich red-brown,' substantially larger spores (150–260 × 150–270 µm, exclusive peridium) (Koske & Walker 1986).

Although *Corymbiglomus* species have not previously been described as having bi-walled spores, it is obvious from Błaszkowski (1995, figs. 6–8) and

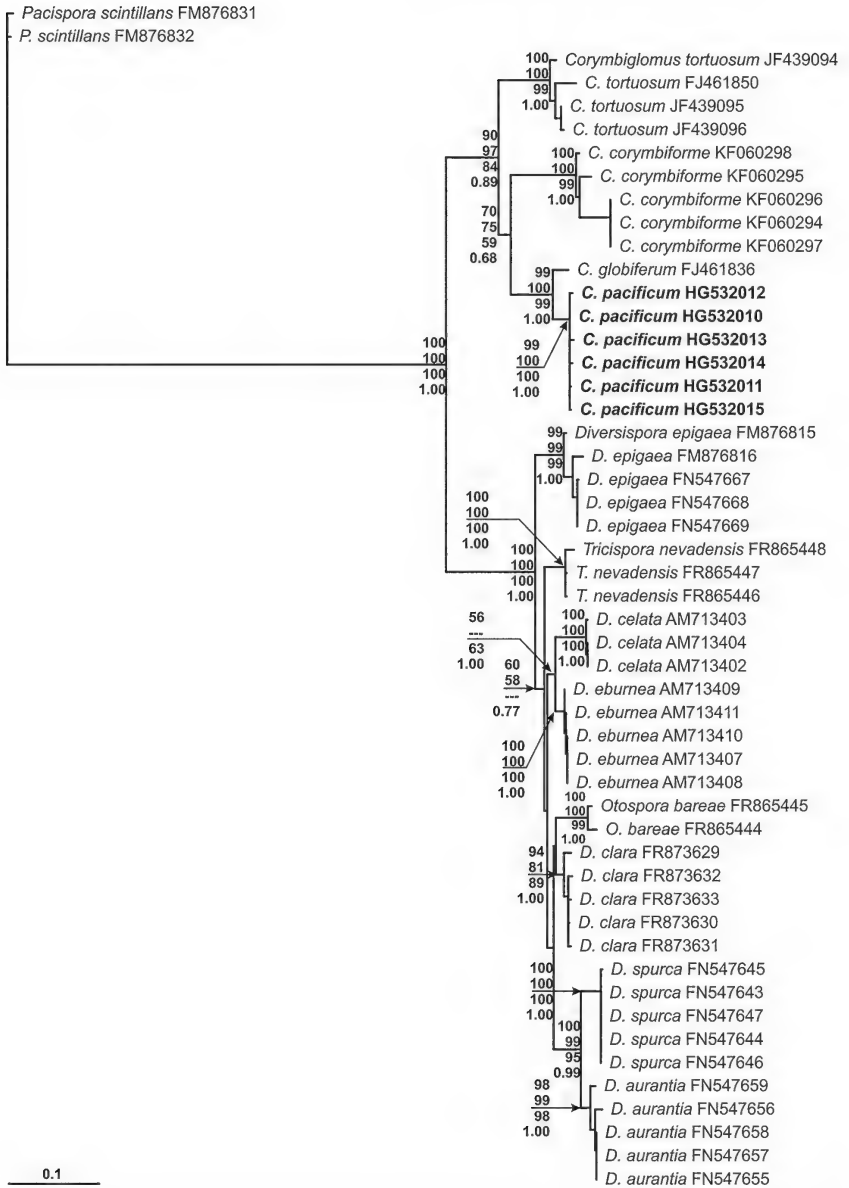


FIG. 9. Phylogenetic reconstruction of the *Diversisporaceae* obtained from partial nuclear LSU rRNA gene sequence analysis. Sequences are labeled with database accession numbers. Support values (from top) are from neighbor-joining (NJ), maximum parsimony (MP), maximum likelihood (ML) and Bayesian analyses, respectively. Sequences obtained in this work are in bold. Only topologies with ≥50% bootstrap values are shown. (Consistency Index = 0.66; Retention Index = 0.91).

Błaszkowski (2012, fig. 55H) that *C. corymbiforme* has a hyaline inner wall. Also *C. globiferum* was presented with two walls (Koske & Walker 1986, Wu & Sylvia 1993). For *C. tortuosum*, however, more analyses are needed on type and non-type spores, as it appears that spores with one and two walls and similar tortuous spore surfaces have both been identified as *C. tortuosum* (Oehl unpublished), and it is not clear if the type material has also bi-walled spores or belongs in another mono-walled genus.

Corymbiglomus pacificum, which is the first *Corymbiglomus* species for which germination has been observed, germinates directly through the spore wall, as in *Pacispora* and *Paraglomus* (Rose & Trappe 1980, Oehl & Sieverding 2004, Oehl et al. 2011a, Mello et al. 2013) and all species in the *Acaulosporaceae* and *Gigasporales.* Lobed structures formed during spore germination (as in *Pacispora*) or persistent germination shields (as in *Acaulosporaceae*, *Dentiscutataceae*, *Intraornatosporaceae*, *Racocetraceae*, and *Scutellosporaceae;* Silva et al. 2008, Oehl et al. 2011d, Mello et al. 2012) have not been observed. Such structures are also not known for *Paraglomus* species. In the *Diversisporaceae,* to which *Corymbiglomus* spp. currently belong, there are two other genera with bi-walled spores, but these form either laterally on or intra-hyphally within the necks of sporiferous saccules (*Otospora* & *Tricispora*), and their germination procedures have not yet been observed. *Diversispora* and *Redeckera* species that form mono-walled spores terminally on hyphae might always germinate through the subtending hyphae, as known for *Diversispora epigaea*, *D. versiformis*, and many mono-walled species of *Glomeraceae* (e.g., http://invam.wvu.edu/the-fungi/classification/diversisporaceae/diversispora/versiforme, Oehl et al. 2011a).

Corymbiglomus pacificum was found at the mouth of Budi Lake (Puerto Saavedra, Chile) close to where the Pacific Ocean periodically floods the lake and lakeshore with seawater that salts the fungal habitat (the rhizospheric soils of *Ammophila arenaria*). Future research will show whether the new fungus is restricted to this particular ecosystem or whether it has a much wider distribution, being more frequently associated with this cosmopolitan sand dune plant species, or is present in other ecosystems without influence of sea water or other salinification. As the four *Corymbiglomus* species have rarely been detected, no conclusion can be drawn about the worldwide occurrence or biogeography of this recently described genus. However, it is remarkable that all four have been reported from sand dunes or other salty ecosystems close to sea or brackish water (e.g., Koske 1987, Koske & Walker 1986, Błaszkowski 1995, Tadych & Błaszkowski 2000). Like *C. pacificum*, *C. corymbiforme* was also first isolated from the rhizosphere of *A. arenaria* (Błaszkowski 1995), while *C. globiferum* was first isolated from American beach grass, the related plant dune species *A. breviligulata* Fernald (Koske & Walker 1986).

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First record of *Erysiphe pulchra* in China on a new host species

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Abstract — *Erysiphe pulchra* (*Erysiphe* sect. *Microsphaera*) was identified on *Cornus kousa* subsp. *chinensis* (≡ *Dendrobenthamia japonica* var. *chinensis*). This is the first record of this species in China, and *C. kousa* subsp. *chinensis* is a new host plant for *E. pulchra*. The Chinese specimen is described, illustrated, and discussed and its affinity has been confirmed using molecular methods.

Key words — powdery mildew, taxonomy, morphology, phylogeny

Introduction

The Qinling Mountain range, which lies at the interface of several floristic regions in north, central, and southwest China, forms a natural boundary between the warm temperate and northern subtropical zones of China, creating unique geographical conditions with characteristic plant and fungal assemblages. Recently, a powdery mildew-forming chasmothecium with dichotomous appendages found growing on *Cornus kousa* subsp. *chinensis* (*Dendrobenthamia japonica* var. *chinensis*) was morphologically identified as *Erysiphe pulchra*.

This species had not been previously recorded in China (Zheng & Yu 1987, Wu & Wu 1991, Chen 1993, Wang et al. 2002, Liu 2010). Therefore, to verify our morphological identification, we analyzed phylogenetically the rDNA ITS sequence from this fungus.

Materials & methods

Living leaves of *Cornus kousa* subsp. *chinensis* containing the powdery mildew teleomorph of the fungus were collected during September 2012 and 2013 in the Qinling Mountains (Taibaihe town) in China. Herbarium specimens were deposited in the Mycological Herbarium of Forestry College, Northwest A & F University, Yangling, Shaanxi Province, China (HMNWAFU).

The specimen was mounted in distilled water and examined by light microscopy (Olympus CX31RTSF, Japan). The teleomorphic features of the fungus, including chasmothecia, appendages, asci, and ascospores, were described, measured, and photographed.

Genomic DNA was extracted from the chasmothecia with Chelex-100 (Walsh et al. 1991; Hirata & Takamatsu 1996). The nuclear rDNA region of the ITS regions (ITS1, ITS2) and 5.8S rRNA gene was amplified by nested PCR, first using the primers ITS5 (White et al. 1990) and P3 (Kusaba & Tsuge 1995) and then the primers PM5 (Takamatsu & Kano 2001) and ITS4 (White et al. 1990). The PCR reactions were carried out in a final volume of 50 µL, containing 27 µL 2× BoisTaq PCR MasterMix, 1 µL each primer; 1 µL extracted DNA, and 20 µL ddH_2O (Hirata & Takamatsu 1996). Thermal cycling in a PTC-200 thermal cycler (BioRad) comprised an initial denaturation step at 95°C for 5 min, 35 cycles of 94°C for 1 min + 60°C for 1 min + 72°C for 1 min, and a final elongation step at 72°C for 8 min. A negative control for each set of reactions replaced template DNA with ddH_2O. The PCR products were separated by electrophoresis on a 2% agarose gel in TAE buffer and purified using the Zymoclean™ Gel DNA Recovery Kit, according to the manufacturer's instructions. The purified DNA products were ligated into the pMD18-T vector (Takara) and transformed into *E. coli* DH5α cells. The cloned fragments were sequenced by Sangon Biotech (Shanghai) Co., Ltd.

All DNA sequences were aligned using Clustal X 1.81 (Thompson et al. 1997), and the alignments were adjusted following Nei & Kumar (2000). All positions containing gaps or missing data were eliminated from the dataset. Cladistic trees were constructed using the neighbor-joining method with the Kimura 2-parameter substitution model in MEGA 4.0 (Tamura et al. 2007). Branch robustness was assessed by bootstrap analysis with 1,000 replicates.

Results

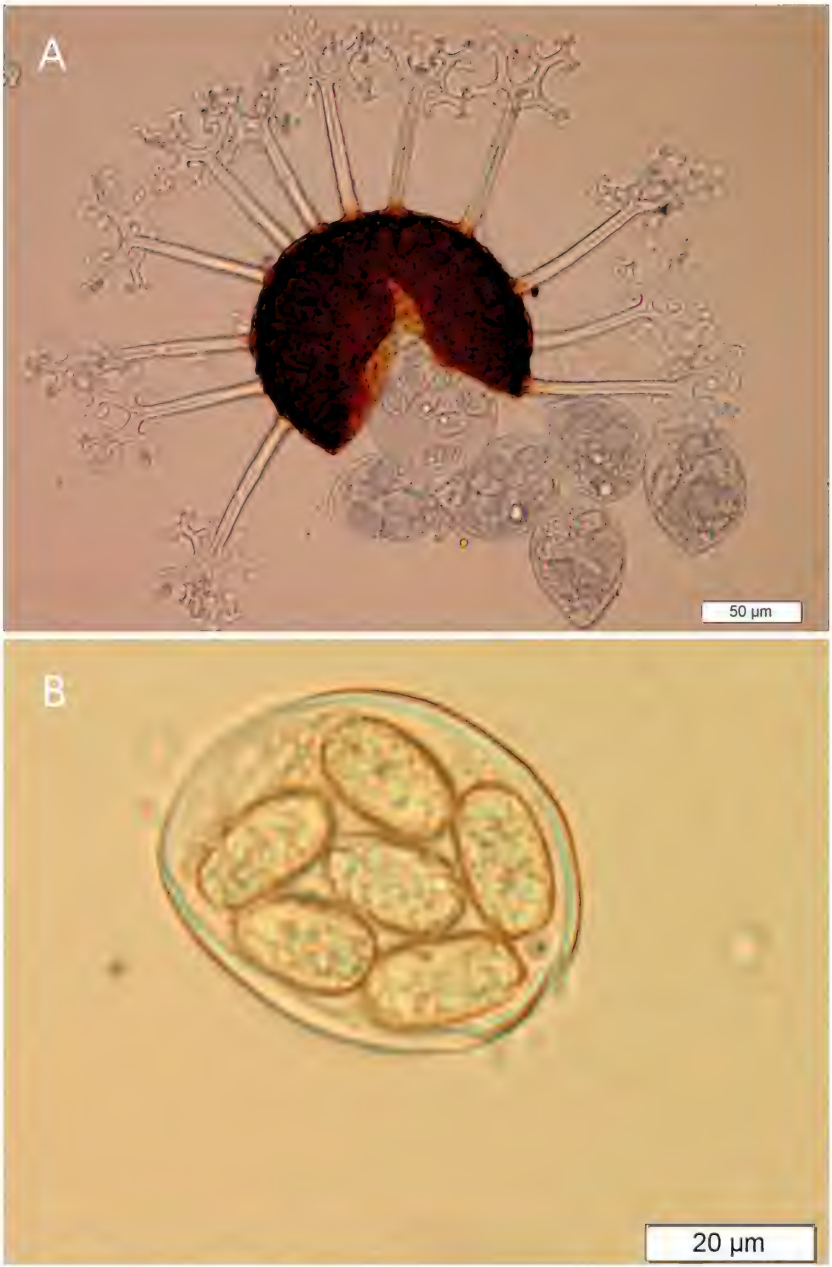
Taxonomic description

Erysiphe pulchra (Cooke & Peck) U. Braun & S. Takam., Schlechtendalia 4: 12. 2000. Pl. 1

= *Microsphaera japonica* Henn., Bot. Jb. 28: 326. 1900.

Mycelium amphigenous, mostly epiphyllous, forming patches or evanescent. Chasmothecia scattered to gregarious, globose or depressed globose, (87.5–) 95–125 µm diam.; peridium cells irregularly polygonal, 7.5–25(–30) µm diam.; appendages 6–12, equatorial, 0.8–1 times the length of the chasmothecial diam., 7.5–10 µm wide along the lower half, aseptate, walls thin above, thick towards the base, smooth to somewhat rough, hyaline or pale brown at the base, apices 3–5 times densely and regularly dichotomously branched, tips distinctly recurved; asci 4–6, broadly ellipsoid-obovoid or subglobose, 55–65 × 42.5–50 µm, stalked or sessile; ascospores 6–8, broadly ellipsoid, 15–22.5 × 10–12.5 µm, colorless.

Specimen examined: **China, Shaanxi,** Qinling Mountains, Taibaihe County, 33°48′57″N 107°12′06″E, alt. 1700 m, on living leaves of *Cornus kousa* subsp. *chinensis*



Pl. 1. *Erysiphe pulchra* (HMNWAFU-CF 2012092) A. Chasmothecia and appendages; B. Asci and ascospores.

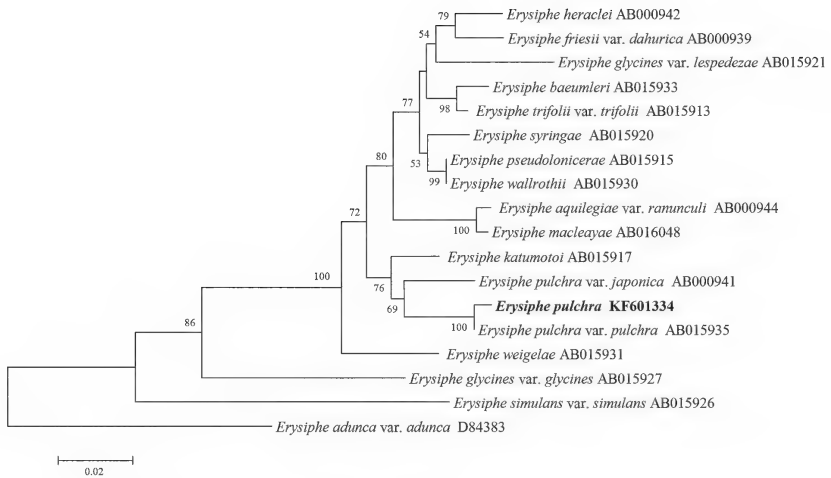


FIG. 1. A neighbor-joining tree based on distances derived from the ITS1-5.8S-ITS2 rDNA sequences from 18 *Erysiphe* taxa, with the Chinese representative of *Erysiphe pulchra* shown in bold. The bar indicates a distance of 0.02.

(Osborn) Q.Y. Xiang (*Cornaceae*), Sep. 2012, L.C. Bai (HMNWAFU-CF 2012092; GenBank KF601334)

Phylogenetic analysis FIG. 1

We phylogenetically compared the new sequence from our specimen with sequences from 17 *Erysiphe* taxa downloaded from GenBank, including *E. simulans* (E.S. Salmon) U. Braun & S. Takam. var. *simulans* and *E. adunca* (Wallr.) Fr. var. *adunca* as outgroup; these 17 sequences were included in the molecular analysis of Takamatsu et al. (1999). The 449 bp long ITS1-5.8S-ITS2 region from the powdery mildew species examined in this study has been deposited in GenBank (KF601334). The DNA sequence retrieved from the Chinese specimen clustered within a strongly supported clade (bootstrap value = 100%) and formed a subclade (bootstrap value = 100%) with the sequence from a Japanese specimen of *Erysiphe pulchra* var *pulchra* on *Cornus kousa* (FIG. 1), indicating that these two sequences represent the same species.

Discussion

The anamorph of *Erysiphe pulchra* has not been identified within collections made in the past two years. However, the chasmothecium we sampled is very similar to descriptions of *Erysiphe pulchra* published by Braun (1987) and Braun & Cook (2012), with the exception of somewhat shorter appendages (0.8–1

times as long as the chasmothecial diam. in the Chinese materials versus 1–2 times in the cited monographs). We follow the taxonomic characterization of *E. pulchra* recently published by Braun & Cook (2012), who reduced *Microsphaera japonica* to synonymy with *E. pulchra* based on Japanese-type materials. Other than our study, all available data on molecular sequence analyses of *E. pulchra* have been exclusively based on Japanese samples. To elucidate the genetic structure of this species and determine the relationship between Asian and North American collections, it will also be necessary to analyze sequences from North American materials.

According to the host plant records for this powdery mildew (Braun & Cook 2012), *Cornus kousa* subsp. *chinensis* appears to be a new host for *E. pulchra.*

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Lactarius taxa by Zdeněk Schaefer – types and other collections in BRNM

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Abstract — Extant BRNM herbarium vouchers of *Lactarius* taxa described, validated, or neotypified by Zdeněk Schaefer are enumerated and discussed. For each taxon, the holotype, neotype, paratypes, syntypes, other original materials, and later collected specimens identified or revised by Schaefer are cited. The nomenclatural status of each taxon is evaluated and information or reference from published revisions/discussions is provided. These data represent an aid for future revisions by morphological-anatomic and molecular methods. The article follows a previous contribution devoted to vouchers in PRM.

Key words — *Basidiomycota*, *Russulales*, taxonomy, nomenclature, Europe

Introduction

Zdeněk Schaefer (1906–1974) was a Czech amateur mycologist who specialized in the genus *Lactarius*. He published more than 20 new taxa (species and varieties). Material studied by him is now stored in the Mycological Department of the National Museum in Prague (PRM) and Moravian Museum in Brno (BRNM). His biography, bibliography, working methods, and vouchers stored in PRM have been described by Holec et al. (2014).

Our intention here is to clarify which types, other original materials, and later collections identified by Schaefer are stored in BRNM. Most of the specimens have not been studied morphologically or molecularly. They should be used for clarification of the limits of Schaefer's new taxa and for future lecto- or neotypifications.

Materials & methods

Methods followed Holec et al. (2014). The following materials from BRNM are cited for each taxon (if extant): holotype, syntypes, paratypes, other original materials, and other collected specimens subsequently identified or revised by Z. Schaefer.

Taxonomic and nomenclatural terms are in accordance with the International Code of Nomenclature for algae, fungi, and plants (McNeill et al. 2012). Herbarium abbreviations follow Thiers (2013). The taxa are presented in alphabetical order. Taxonomic remarks are based on recent European *Lactarius* monographs (Bon 1980, Korhonen 1984, Heilmann-Clausen et al. 1998, Basso 1999, Kalamees 2011).

Results & discussions

Lactarius albocremeus Z. Schaef., Česká Mykologie 12: 211, 1958.

Latin diagnosis/description: Česká Mykologie 12: 211, 1958.

Detailed Czech description: Česká Mykologie 12: 208–209, 1958.

Holotype — designated. Slovakia, Western Carpathians, NNE of Poprad, between the villages of Spišská Belá and Lendak, site called „Blomwiesen", in fen meadow, close to *Betula* and *Salix* trees, alt. about 800 m, 11 Aug. 1957 leg. K. Kříž (BRNM 242123; see also Antonín & Vágner 1999).

Isotype — PRM 584029 (for details see Holec et al. 2014).

Nomenclatural status — valid, legitimate.

Taxonomic remarks — see Holec et al. (2014).

Lactarius chrysophyllus Z. Schaef., Česká Mykologie 11: 52, 1957.

Latin diagnosis/description: Česká Mykologie 11: 52–53, 1957.

Detailed Czech description: Česká Mykologie 11: 50–52, 1957.

Holotype — not designated.

Syntypes — Czech Republic, Moravia, Kuřim, on a slope Na pískách, on a grassy and mossy soil in a *Picea* and *Quercus* forest, alt. 350 m, 12 Nov. 1945 leg. F. Šmarda (BRNM 243022, as *L. pyrogalus*); Tišnov, in a Rovinky forest near Heroltice, on soil in *Carpinus* forest, 15 July 1944 leg. F. Šmarda (BRNM 243020, as *L. pyrogalus*).

Nomenclatural status — valid, legitimate.

Taxonomic remarks — Bon (1980) considered *L. chrysophyllus* a separate species within sect. *Glutinosi*, subsect. *Vietini*, stirps *Vietus*. Basso (1999: 138, 143–144) considered *L. chrysophyllus* a synonym of *L. hysginus* (Fr.) Fr.

Lactarius cookei Z. Schaef., Česká Mykologie 14: 236, 1960.

Latin diagnosis/description: Česká Mykologie 14: 236–237.

Detailed Czech description: Česká Mykologie 14: 230–232.

Holotype — designated. Slovakia, Western Carpathians, E margin of High Tatra Mts., NNW of Kežmarok, close to the village of Lendak, pasture near a forest, under isolated *Picea abies* trees, Tertiary flysh bedrock, alt. about 800 m, 11 Aug. 1957 leg. J. Kubička et K. Kříž. Nonexistent.

Later collections identified by Schaefer — **CZECH REPUBLIC, Moravia**, Herálec near Svratka, autochthonous *Picea* forest (*Abieto-Piceetum sphagnetum*), 16 Sep. 1965 leg. F. Šmarda (BRNM 242330).

Nomenclatural status — valid, legitimate.

Taxonomic remarks — species of unclear identity. Bon (1980) considered *L. cookei* a good species of sect. *Plinthogali*, subsect. *Ruginosi* (together with *L. pterosporus* Romagn., *L. subruginosus* J. Blum ex Bon, *L. ruginosus* Romagn., and *L. terenopus* Romagn.). For a brief discussion see Basso (1999: 689–690), who compared the species with *L. picinus* Fr. and *L. romagnesii* Bon.

Lactarius cupricolor Z. Schaef., Česká Mykologie 20: 158, 1966.

Latin diagnosis/description: Česká Mykologie 20: 158, 1966.

Detailed Czech description: Česká Mykologie 20: 154–156, 1966.

Detailed German description: Česká Mykologie 20: 156–157, 1966.

Holotype — designated (PRM 584026; see Holec et al. 2014).

Paratypes — Czech Republic, central Bohemia, Praha, Divoká Šárka, *Quercus* forest, 7 Sep. 1937 leg. J. Herink (BRNM 325878); Moravia, Lipůvka near Brno, Dubová hora hill, alt. 570 m, herb-rich *Fagus* forest, 14 Aug. 1961 leg. F. Šmarda (BRNM 242353; the date 14 Aug. 1960 was published by Schaefer as it was originally written on the herbarium label; however, later it was corrected to 1961 by Šmarda). There are two other paratypes in PRM (Holec et al. 2014).

Later collections identified by Schaefer — **CZECH REPUBLIC, Moravia**, Litenčické vrchy Mts., Kunkovice, Kunkovický les forest, alt. c. 280 m, under *Carpinus* in a *Quercus*, *Carpinus*, *Tilia*, and *Betula* stand, 6 Sep. 1968 leg. K. Kříž (BRNM 686362); Lelekovice, Babí lom forest, a place called Líchy, 29 June 1952 leg. F. Šmarda (BRNM 242354); Kuřim, Čebínka hill, *Quercus-Carpinus* forest, 20 June 1951 leg. F. Šmarda (BRNM 242351); Ždánický les hills, Ždánice, a place called U slepice, herb-poor *Fagus* forest (*Fagetum pauper*), 11 Sep. 1966 leg F. Šmarda et al. (BRNM 243031).

Nomenclatural status — valid, legitimate.

Taxonomic remarks — species of unclear identity. Bon (1980) considered *L. cupricolor* a separate species of sect. *Glutinosi*, subsect. *Vietini*, stirps *Glutinopallens*. Basso (1999: 131–132) placed it under *L. vietus* (Fr.) Fr. but also compared it with *L. pallidus* Pers.

Lactarius hortensis* var. *olivaceus Z. Schaef., Česká Mykologie 26: 143, 1972.

Latin diagnosis by Schaefer: Česká Mykologie 26: 143.

Original Czech diagnosis: Česká Mykologie 26: 143.

Holotype — designated. Czech Republic, Moravia, N of Brno, Kuřim, in a garden under *Corylus avellana*, 25 Aug. 1968, leg. K. Kříž (BRNM). [The label of BRNM 243701 agrees with the protologue designation in every detail except the collector's name, which is given as H. Vališ. Despite this discrepancy, BRNM 243701 is almost certainly the holotype.]

Nomenclatural status — valid, legitimate.

Taxonomic remarks — Schaefer (1972) considered *L. hortensis* Velen. a very variable species. His var. *olivaceus* represents a taxon with an olivaceous tinged pileus, soon brightly yellow or orange lamellae, and growing on acid substrates.

Bon (1980) considered it a separate taxon, which he erroneously cited as "var. *olivascens*." Basso (1999: 117, 123) considered it synonymous with *L. pyrogalus* (Bull.) Fr.

Lactarius hortensis* var. *tephroleucus Z. Schaef., Česká Mykologie 26: 143, 1972.

Latin diagnosis by Schaefer: Česká Mykologie 26: 143.

Original Czech diagnosis: Česká Mykologie 26: 143.

Holotype — designated. Czech Republic, Moravia, Veverská Bítýška, in stand of *Corylus avellana*, 19 Aug. 1957 leg. K. Kříž et Z. Schaefer (BRNM). [Although Schaefer (1972) stated that the specimen was preserved in BRNM, it was not found there.]

Nomenclatural status — valid, legitimate.

Taxonomic remarks — According to Schaefer (1972), this variety represents a small fungus with an opaque, variably grey coloured pileus, broad lamellae, an incarnate-ferrugineous tinged stipe cuticle, and rather narrow stipe growing under *Corylus avellana* on basic substrates in rather warm conditions. Bon (1980) mentioned it only in brackets as a small thermophilic calcicolous variety. Basso (1999: 117, 123) considered it synonymous with *L. pyrogalus*.

Lactarius pearsonii Z. Schaef., Česká Mykologie 22: 19, 1968.

= *Lactarius mairei* var. *zonatus* A. Pearson, Naturalist, London: 100, 1950.

Latin description: Česká Mykologie 22: 19, 1968.

Czech discussion: Česká Mykologie 22: 17, 1968. Detailed Czech description cited by Schaefer (1968: 17) was published by Pouzar (1954: 40–41, as "*L. aurantiacoochraceus*").

Holotype — designated (PRM 193531; see Holec et al. 2014).

Other original materials (all identified as *L. pearsonii* but cited only by locality names in the protologue) — **Czech Republic**, **Moravia**, Brno, Hády, in a broadleaved forest (*Quercus*, *Carpinus betulus*), 19 Aug. 1972 leg. A. Vágner (BRNM 686364); Brno, Hády, under *Quercus* in a broadleaved forest, 6 Aug. 1972 leg. A. Vágner (BRNM 686363); Dolní Věstonice, Děvičky, alt. 320 m, an *Quercus-Carpinus* forest with intermixed *Fraxinus* and *Tilia* (*Querceto-Carpinetum fraxino-tillietosum*), 9 July 1963 leg. F. Šmarda (BRNM 242932); Starý Poddvorov near Hodonín, Horní Kapansko forest, alt. 250 m, thermophilic *Quercus* forest (*Querceto-Potentilletum albae*), 24 June 1962 leg. K. Koncerová (BRNM 242933). [Although, the determiner is not noted for the last three specimens, the fungus name is written in Schaefer's handwriting.] There are two more collections in PRM (Holec et al. 2014).

Nomenclatural status — valid, legitimate.

Taxonomic remarks — Bon (1980) mentioned *L. pearsonii* as a synonym of *L. mairei* var. *zonatus*. For a synopsis of other published discussions and revisions that show *L. pearsonii* as synonymous with *L. mairei* Malençon, see Holec et al. (2014).

Lactarius pinicola Smotl. ex Z. Schaef., Schweizerische Zeitschrift für Pilzkunde 48: 141, 1970.

"*Lactarius deliciosus* var. *pinicola*" Smotlacha, Atlas hub jedlých a nejedlých [Atlas of edible and inedible fungi]: 219, 1947, nom. inval. [no Latin description].

Latin diagnosis: Schaefer (1970: 141–142).

German discussion: Schaefer (1970: 139–142).

Holotype — designated (PRM 584024; see Holec et al. 2014).

Other collections identified by Schaefer — **CZECH REPUBLIC, Moravia**, Kuřim, Bělč forest, *Quercus* forest, alt. 320 m, 31 Aug. 1960 leg. et det. F. Šmarda as *L. salmonicolor*, rev. Z. Schaefer (BRNM 326197); in mosses (*Hypnum schreberi*) in mixed forest (*Picea*, *Quercus*, *Betula*), 13 Oct. 1953 leg. J. Herink et F. Šmarda, det. J. Herink as *L. subsalmoneus*, rev. Z. Schaefer (BRNM 326196); Hluk, Kobylí hlava steppe slope, *Betula*, *Quercus*, admixed *Pinus*, Sep. 1969 leg. J. Hubáček (BRNM 326198); Kuřim, Šiberná forest, alt. 350 m, thermophilic *Quercus* forest with *Potentilla alba* (*Querceto-Potentilletum albae*), 6 Aug. 1961 leg. F. Šmarda (BRNM 242948, 242951); *Quercus* forest with *Pinus sylvestris*, 18 Aug. 1964 leg. F. Šmarda (BRNM 242949); Ždánický les hills, Zdravá Voda near Žarošice, Lísov forest, *Quercus-Carpinus* forest with *Poa nemoralis* (*Querceto-Carpinetum poetosum nemoralis*), alt. 350 m, 4 Sep. 1963 leg. F. Šmarda (BRNM 242950). [In the last four specimens, the determiner is not stated; however, the fungus name is written in Schaefer's handwriting.]

Nomenclatural status — valid, legitimate.

Taxonomic remarks — synonymous with *L. deliciosus* (L.) Gray (for synopsis of published discussions and revisions, see Holec et al. 2014).

Lactarius pyrogalus* var. *polyzonus (Velen.) Z. Schaef., Česká Mykologie 26: 144, 1972.

≡ *Lactarius polyzonus* Velen., České houby [Czech fungi], part 1: 163, 1920.

Latin diagnosis: Česká Mykologie 26: 144.

Czech discussion: Česká Mykologie 26: 144.

Holotype — designated. Czech Republic, Praha-Radotín, near the village of Kosoř, thermophilous grove composed of deciduous trees, Aug. 1918 (Velenovský 1920: 163). Nonexistent (Holec & Suková 2007).

Neotype — Czech Republic, southern Moravia, near the village of Dolní Věstonice, Pálava (= Pavlovské vrchy) hills, near the castle ruins of Děvičky, *Acer-Fraxinus* forest, 19 Aug. 1955 leg. F. Šmarda et Z. Schaefer (BRNM), designated by Schaefer (1972: 144). [The specimen BRNM 242310, labelled by Schaefer as "*L. carpinetorum* = *L. circellatus*", probably represents the neotype as it is the only BRNM specimen from this *Lactarius* group that agrees with Schaefer's neotype designation.]

Nomenclatural status — valid, legitimate.

Taxonomic remarks — taxonomic value of this variety is unclear. Bon (1980) included it as a separate taxon in his key, while Basso (1999: 123–124) discussed it under *L. pyrogalus*.

Lactarius pyrogalus* var. *umbrosus Z. Schaef., Česká Mykologie 26: 145, 1972.

Czech and Latin diagnoses: Česká Mykologie 26: 145, 1972.

Holotype — designated (for details see Holec et al. 2014). Nonexistent, probably discarded by Schaefer's family.

Other collections identified by Schaefer — **CZECH REPUBLIC, Moravia**, Ždánický les hills, Zdravá Voda near Žarošice, forest with dominating *Carpinus*, mixed with *Tilia* and *Quercus* (*Querceto-Carpinetum caricetosum pilosae*), alt. 390 m, 22 Aug. 1961 leg. F. Šmarda, det. Z. Schaefer as *L. adscitus* (BRNM 325705). Schaefer (1972) mentioned the identity of *L. pyrogalus* var. *umbrosus* with *L. adscitus*. Therefore, the specimen certainly represents his new variety.

Nomenclatural status — valid, legitimate.

Taxonomic remarks — taxonomic value of this variety is unclear. Bon (1980) cited it only in brackets, and Basso (1999: 124) discussed it under *L. pyrogalus*.

"***Lactarius russuloides***" Z. Schaef., Česká Mykologie 12: 205, 1958, nom. inval.

Latin diagnosis/description: none.

Detailed Czech description: Česká Mykologie 12: 205–206, 1958.

Holotype — not designated

Other original materials — **CZECH REPUBLIC, Moravia**, Telč, Hulišťata forest, in mosses and humus in *Vaccinium myrtillus* under *Pinus*, alt. c. 600 m, 23 Aug. 1957 leg. Z. Schaefer (BRNM 242887, as *L. musteus*).

Other collections identified or revised by Schaefer — **CZECH REPUBLIC, Moravia**, Rozdrojovice, mixed forest (*Quercus*, *Pinus*), 29 Oct. 1967 leg. K. Koncerová (BRNM 326356).

Nomenclatural status — invalid: lacking Latin description or diagnosis and holotype designation. For details see Holec et al. (2014).

Taxonomic remarks — Basso (1999: 171, 175) considered "*L. russuloides*" synonymous with *L. musteus* Fr.

Lactarius subtomentosus Z. Schaef., Česká Mykologie 14: 237, 1960, nom. illegit., non Berk. & Ravenel 1859.

Latin diagnosis/description: Česká Mykologie 14: 237.

Detailed Czech description: Česká Mykologie 14: 235–236.

Holotype — designated. Slovakia, central Slovakia, Zvolen district, Sliač spa, pasture at margin of a *Picea abies* forest, 23 Nov. 1958 leg. K. Kříž. [According to Schaefer (1960), it was preserved in herbarium "Fungi Moravici Brno" which is most probably the personal herbarium of František Šmarda, later transferred to BRNM. However, the collection was not found in BRNM.]

Nomenclatural status — valid, illegitimate (a later homonym of *L. subtomentosus* Berk. & Ravenel 1859; and superfluous [synonymised with *L. tomentosus* Cooke 1883]).

Taxonomic remarks — Schaefer (1960) himself stated that his new species was synonymous with "*Lactarius tomentosus* sensu Cooke." However, as *L. tomentosus* Cooke is accepted as a legitimate name (a nom. nov. based on the illegitimate *Agaricus tomentosus* J. Otto), *L. subtomentosus* is a superfluous name and therefore illegitimate (ICN Art. 52.2(e)).

Bon considered *L. subtomentosus* Z. Schaef. synonymous with *L. tomentosus* Cooke. Basso (1999: 474) discussed the species under *L. helvus* (Fr.) Fr.

Lactarius syringinus Z. Schaef., Česká Mykologie 10: 171, 1956.

Latin diagnosis/description: Česká Mykologie 10: 171–172, 1956.

Detailed Czech description: Česká Mykologie 10: 168–171, 1956.

Holotype — designated. Currently nonexistent, probably not preserved by Schaefer (for details see Holec et al. 2014).

Other collections identified by Schaefer — **CZECH REPUBLIC, eastern Bohemia**, Telecí, 27 Sep. 1963 leg. E. Horníček (BRNM 243323). [The determiner is not stated on the label; however, the fungus name is written in Schaefer's handwriting.]

Nomenclatural status — valid, legitimate.

Taxonomic remarks — Bon (1980) mentioned it only in brackets together with *L. vietus*. For a synopsis of other published discussions and revisions that show that *L. syringinus* is either a good species or, more probably, a synonym of *L. vietus*, see Holec et al. (2014).

Lactarius tatrorum Z. Schaef., Česká Mykologie 12: 211, 1958.

Latin diagnosis/description: Česká Mykologie 12: 211–212.

Detailed Czech description: Česká Mykologie 12: 209–210.

Holotype — designated. Slovakia, Western Carpathians, High Tatra Mts.: Belanské Tatry group, E slope of Mt. Bujačí, under *Salix reticulata*, *Pinus mugo*, *Dryas octopetala*, and *Carex tatrorum*, on calcareous bedrock, alt. 1800–1940 m, 14 Aug. 1957 leg. J. Kubička et K. Kříž (BRNM 243369).

Nomenclatural status — valid, legitimate.

Taxonomic remarks — synonymous with *Lactarius nanus* J. Favre (Basso 1999: 144, 148).

Conclusions

The inventory of BRNM voucher specimens of *Lactarius* taxa described by Schaefer showed that eight nomenclaturally important collections are extant (three holotypes, two paratypes, two syntypes, one neotype) together with five other original collections. They should be studied by morphological-anatomic and molecular methods, as some may represent good species, and all provide a good basis for future revisions and typifications by *Lactarius* monographers.

Acknowledgements

We thank the reviewers, Annemieke Verbeken (Ghent University, Gent, Belgium) and Maria Teresa Basso (Alassio, Italy) for their valuable advices, and Shaun Pennycook (Auckland, New Zealand) for very valuable remarks. The studies of V. Antonín were realized by the support provided to the Moravian Museum by the Ministry of Culture of the Czech Republic as part of its long-term conceptual development programme for research institutions (DKRVO, ref. MK000094862). The work by J. Holec was financially supported by the Ministry of Culture of the Czech Republic (DKRVO 2013/06, National Museum, 00023272).

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Lembosia bezerrae, a new asterinaceous fungus associated with a terrestrial orchid from Bahia, Brazil

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Abstract — A new species of *Lembosia* was found associated with living leaves of *Sobralia liliastrum* (*Orchidaceae*) in a stretch of Atlantic Forest in Serra da Jibóia, Bahia, Brazil. This species is fully described, illustrated, discussed, and compared with allied species on *Orchidaceae*.

Key words — *Dothideomycetes*, *Asterinales*, foliicolous fungi, taxonomy, tropical fungi

Introduction

Sobralia Ruiz & Pav. is a large genus in the *Orchidaceae* with about 150 species distributed throughout Mexico, Peru, Bolivia, and Brazil. *Sobralia* species are usually terrestrial and herbaceous (Szlachetko et al. 2009). Plants of *S. liliastrum* with a black fungus covering portions of their living leaves were observed in a stretch of Atlantic Forest in Serra da Jibóia, Bahia, Brazil. This orchid species has potential for cultivation and marketing due its beautiful white flowers with yellow lobes (Plate 1). Although observed only on plants in nature, the black fungus could become a potentially serious problem for orchid growers, because superficial black fungal colonies covering portions of the foliage decrease the aesthetic value of ornamental plants (Pereira et al. 2006) and there are no registered chemical products to control fungi on orchids (Silva et al. 2008; Silva & Pereira 2008; Lopes et al. 2009). Examination of the collected samples indicated that the black colonies belonged to *Lembosia*, a genus proposed by Léveillé in 1845 with *L. tenella* Lév. as its type. This genus is characterized by a linear or Y-shaped hysterothecium opening with a longitudinal slit and adherence to its host using superficial hyphae with lateral hyphopodia (Song & Hosagoudar 2003, Bezerra 2004). In this paper, we describe our collections as a new *Lembosia* species on *Orchidaceae*.

Material & methods

Leaves covered with black colonies were collected, photographed, and dried in a plant press. Small samples were examined under an Olympus SZ40 stereomicroscope; the fungus was removed from dried leaf colonies and mounted in lactophenol and Melzer's reagent. Observations, measurements, and drawings were made with a Carl Zeiss Standard W light microscope (Göttingen, Germany). The nail polish technique was used to study colony morphology (Hosagoudar & Kapoor 1984). Photographs were obtained on an Olympus BX51 microscope equipped with a digital camera (E–volt 330). For scanning electron microscopy (SEM), air-dried material was directly mounted and coated with a thin layer of gold using a sputter coater (Balzers® model FDU 010) for 2 min. Photographs were obtained using a Carl-Zeiss Model LEO VP 1430 scanning electron microscope. Representative specimens of the fungi were deposited in the herbarium of the Universidade Federal de Viçosa (Herbarium VIC).

Taxonomy

Lembosia bezerrae Firmino & O.L. Pereira, **sp. nov.** PLATES 1c,2,3

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Differs from *Lembosia sertiferae* by its straight hyphae, smaller and rounded hyphopodia, larger hysterothecia, and smaller ascospores.

TYPE: Brazil, Bahia, Santa Terezinha, Serra da Jibóia, on living leaves of *Sobralia liliastrum* Lindl. (*Orchidaceae*), 25 September. 2010, O. L. Pereira (VIC 31942, **holotype**).

ETYMOLOGY: referring to the great Brazilian mycologist, Dr. José Luiz Bezerra.

COLONIES epiphyllous, irregular to circular, single to confluent, black. HYPHAE straight to flexuous, branching, irregular, brown, septate, hyphal cells cylindrical, 4–5 µm, smooth. HYPHOPODIA few, entire, sessile, globose to pyriform, straight to angular, unicellular, 4.5–5 × 4.5–5 µm, brown, penetration peg in middle part of hyphopodia cell. HYSTEROTHECIA superficial, developed below mycelium surface, mostly linear, rarely Y-shaped, single, fringed at margins, 521.5–1853 × 85–109 µm diam., dark brown to blackish, open by longitudinal fissures. SCUTELLUM radiate, composed of isodiametric to cylindrical cells, straight. ASCI saccate to ovoid, bitunicate, 8-spored, 27.5–34 × 12–17.5 µm, hyaline. PARAPHYSES hyaline, filiform and unbranched. ASCOSPORES fusiform, 2-celled, constricted at the septum, hyaline when immature, becoming brown at maturity, smooth, 14–16 × 4–5 µm. ANAMORPH absent.

COMMENTS — Four species of *Lembosia* (TABLE 1) have been reported previously in association with orchidaceous hosts (Song & Hosagoudar 2003; Silva & Pereira 2008). Of these, only *Lembosia epidendri* Meir. Silva & O.L. Pereira is known from Brazil (Silva & Pereira 2008).

Lembosia bezerrae is similar to *L. sertiferae* Syd., *L. dendrochili* Lév., and *L. epidendri*. However, *L. sertiferae* differs by its reticulately branched hyphae, larger and lobately incised hyphopodia, smaller hysterothecia, and larger

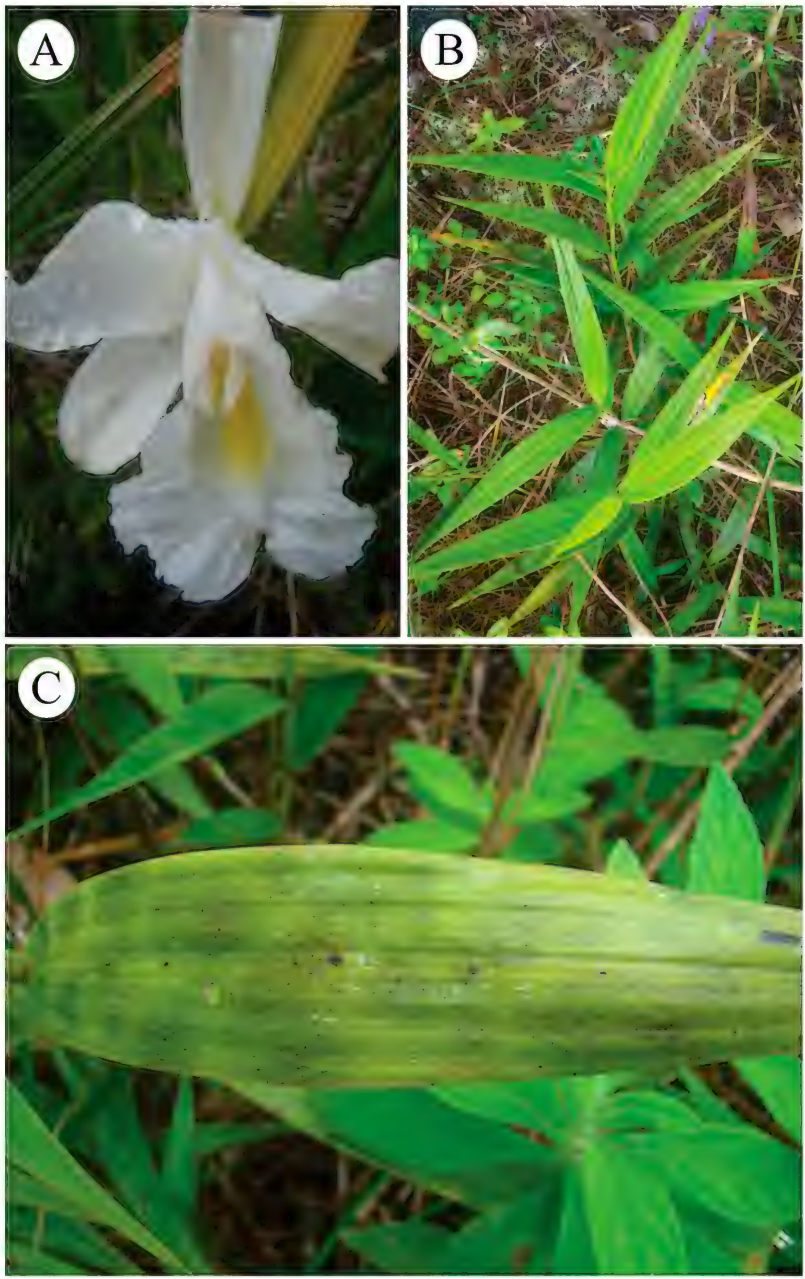

Plate 1. *Sobralia liliastrum*. A: White flowers with yellow lobe. B: Infected plant in the field. C: Symptoms on naturally infected plant.

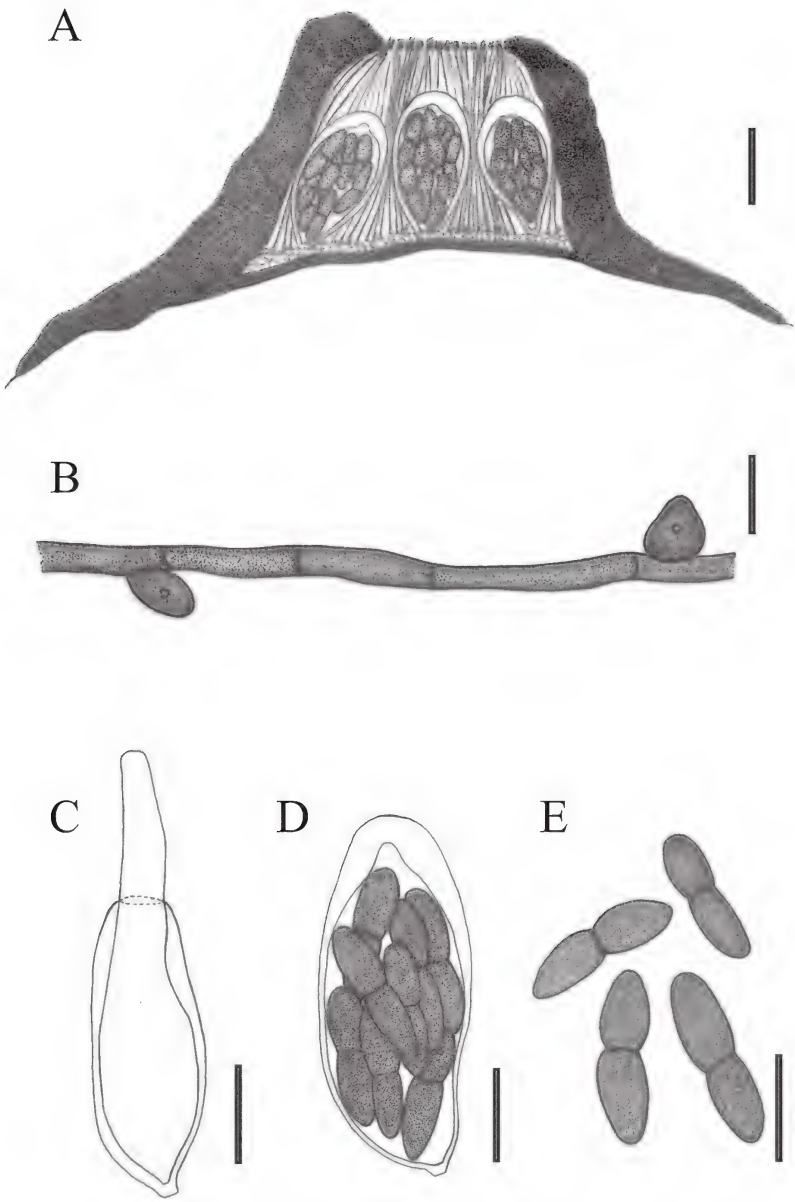

Plate 2. *Lembosia bezerrae* (holotype, VIC 31942).
A: Cross section of a hysterothecium. B: Surface mycelium with hyphopodia.
C: Fissitunicate ascus. D: Bitunicate ascus with mature ascospores.
E: Brown, smooth, fusiform ascospores. Scale bars: A = 20 µm; B,C,D,E = 10 µm.

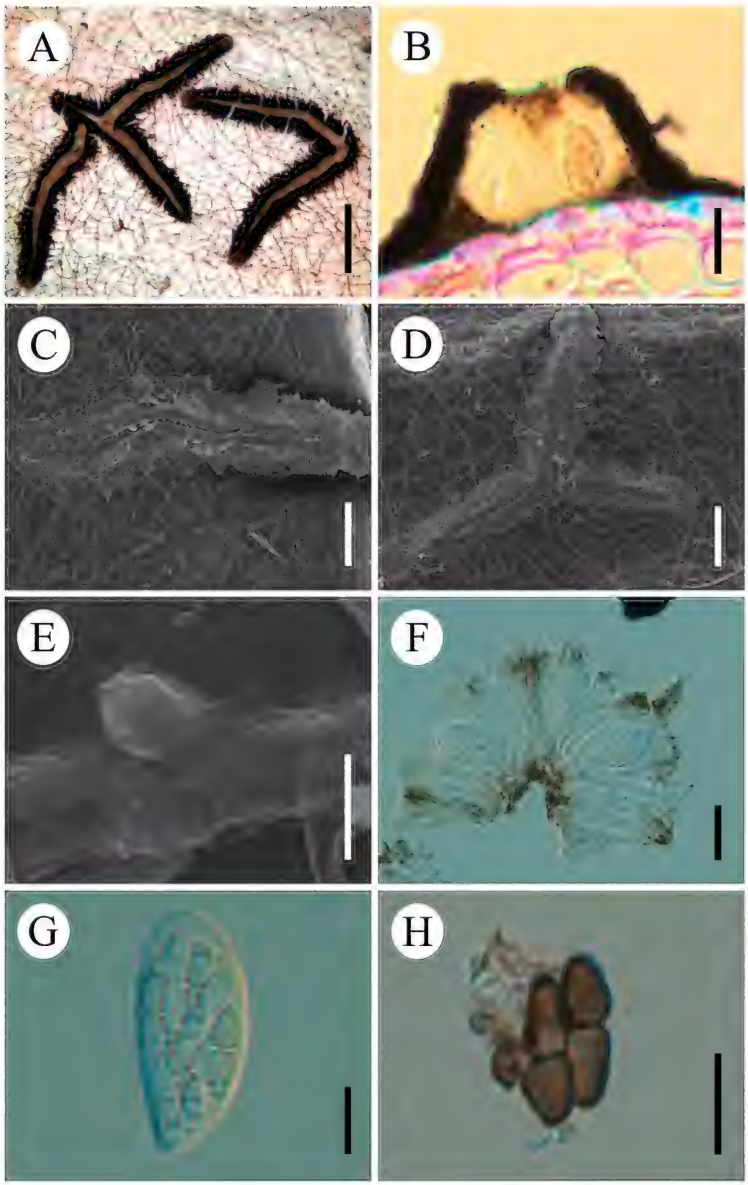

Plate 3. *Lembosia bezerrae* (holotype, VIC 31942). A: Part of a colony with open hysterothecia and surface mycelium. B: Cross section of a hysterothecium. C: Linear hysterothecium. D: Y-shaped hysterothecium. E: Sessile, globose, straight to angular, unicellular hyphopodium. F: Agglomerate and parallel asci. G: Bitunicate ascus with hyaline ascospores. H: Brown, smooth, fusiform ascospores. Scale bars: A = 200 µm; B,F = 20 µm; C,D = 100 µm; E = 5 µm; G,H = 10 µm.

Table 1. Biometric data (μm) of *Lembosia* species on *Orchidaceae*.

Species	Hyphae	Hyphopodia	Hysterothecia	Asci	Ascospores
L. bezerrae	4–5	4.5–5	520–1850 × 85–110	27.5–34 × 12–17.5	14–16 × 4–5
L. rolfsii	—	—	360–1000 × 160	20–40 × 8–15	10–16 × 4–5
L. sertiferae	3–4	6–8	300–800 × 160–220	35–42 × 20–24	16–18 × 6–7
L.dendrochili	3–4	6–7	400–650 × 120–160	45 × 28	16–19 × 7–8
L. epidendri	< 3	6–9.5	320–580 × 135–250	28–63 × 16–25	16–22 × 6–9.5

ascospores (Sydow 1939); *L. dendrochili* differs by its smaller hysterothecia and hyphae, and larger hyphopodia and ascospores (Léveillé 1845); and *L. epidendri* differs by its smaller hysterothecia, asci, and hyphae and larger hyphopodia and ascospores (Silva & Pereira 2008).

Although *Lembosia rolfsii* W.T. Horne is morphologically close to *L. bezerrae*, it probably is better placed in *Maheshwaramyces* Hosag. due to the presence of subcuticular mycelium and conidia on superficial mycelium (Hosagoudar et al. 2009, Horne 1905). *Lembosia bezerrae* is the first member of the *Asterinales* reported on the orchid genus *Sobralia*.

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A new species of *Pseudospiropes* and new *Cordana* and *Sporidesmiopsis* records from China

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Abstract — *Pseudospiropes xishuangbannicus* sp. nov. from dead branches of *Tsoongiodendron odorum* is described and illustrated. *Cordana lithuanica* and *Sporidesmiopsis dennisii* are recorded for the first time from China. These species were collected from tropical forests in Hainan and Yunnan Provinces, China.

Key words — anamorphic fungi, taxonomy

Introduction

Pseudospiropes was erected by Ellis (1971) with *P. nodosus* (Wallr.) M.B. Ellis as type. Subsequently Castañeda et al. (2001) reviewed and segregated three genera from this genus, including *Minimelanolocus* R.F. Castañeda & Heredia, *Nigrolentilocus* R.F. Castañeda & Heredia, and *Matsushimiella* R.F. Castañeda & Heredia. *Pseudospiropes* is currently distinguished by polyblastic, terminal and intercalary, sympodial conidiogenous cells with enlarged thickened protuberant melanized conidiogenous loci producing solitary acropleurogenous distoseptate conidia.

Numerous fungi collected in tropical and subtropical forests of southern China have recently been reported (Zhang et al. 2009, 2012; Ma et al. 2011a, 2012; Ren et al. 2012). In our ongoing study of anamorphic fungi on dead wood, we found a new *Pseudospiropes* species and two new records for China. These three species are described and illustrated, and the new species is compared with similar species. The specimens are deposited in HSAUP (Herbarium of the Department of Plant Pathology, Shandong Agricultural University) and HMAS (Mycological Herbarium, Institute of Microbiology, Chinese Academy of Sciences).

Taxonomy

Pseudospiropes xishuangbannicus L.G. Ma & X.G. Zhang, **sp. nov.** Fig. 1

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Differs from *Pseudospiropes linderae* by its larger, elongated ellipsoidal conidia with more septa.

Type: China, Yunnan Province: the National Natural Reserve of Xishuangbanna, on dead branches of *Tsoongiodendron odorum* Chun (*Magnoliaceae*), 28 Oct. 2011, L.G. Ma (**holotype**, HSAUP H2092; **isotype** HMAS 243438).

Etymology: *xishuangbannicus*, refers to the type locality.

Colonies on natural substratum effuse, brown, hairy. Mycelium superficial and immersed, with branched, septate, pale brown, smooth hyphae, 1–2 µm wide. Conidiophores distinct, single, erect, unbranched, straight or flexuous, smooth, brown to dark brown, paler toward the apex, 6–12-septate, 80–140 µm long, 4–5 µm wide. Conidiogenous cells holoblastic, polyblastic,

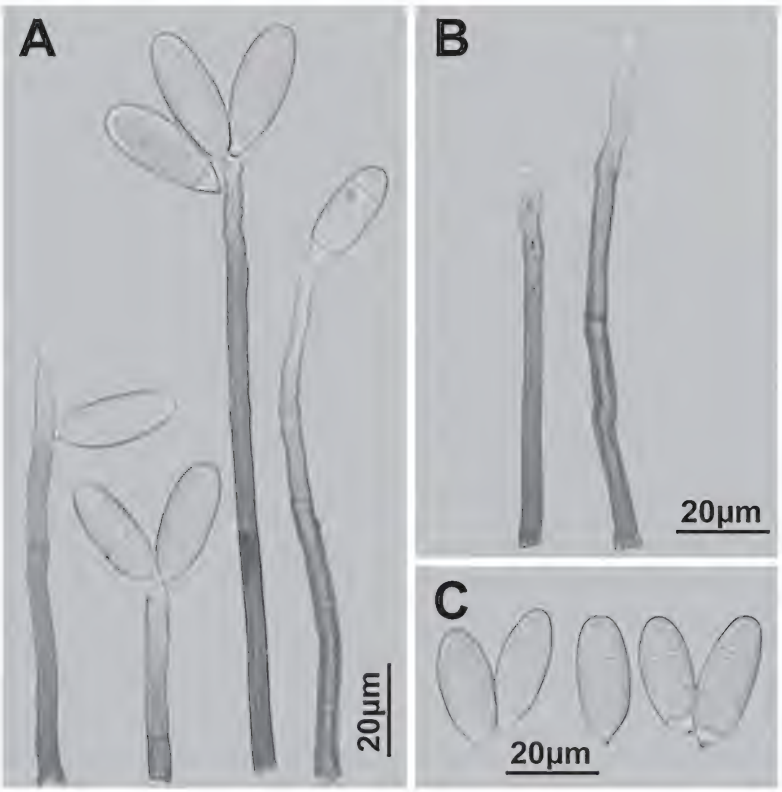

Fig. 1. *Pseudospiropes xishuangbannicus* (Holotype, HSAUP H2092).
A. Conidiophores and conidia. B. Conidiophores with conidiogenous cells. C. Conidia.

indeterminate, terminal becoming intercalary, pale brown, integrated, always with sympodial proliferations. Conidiogenous loci enlarged, thickened, protuberant and dark, lenticular. Conidial secession schizolytic. Conidia solitary, dry, acropleurogenous, simple, elongated ellipsoidal, brown, smooth, 4-distoseptate, 25–32 × 10–12 µm, 0.5–1.5 µm at the narrowly truncate base.

Pseudospiropes xishuangbannicus is most similar to *P. linderae* Jian Ma et al. in conidial shape. However, the conidia of *P. linderae* are smaller and have fewer septa (14–17 × 5.5–6.5 µm, 3-distoseptate; Ma et al. 2011b).

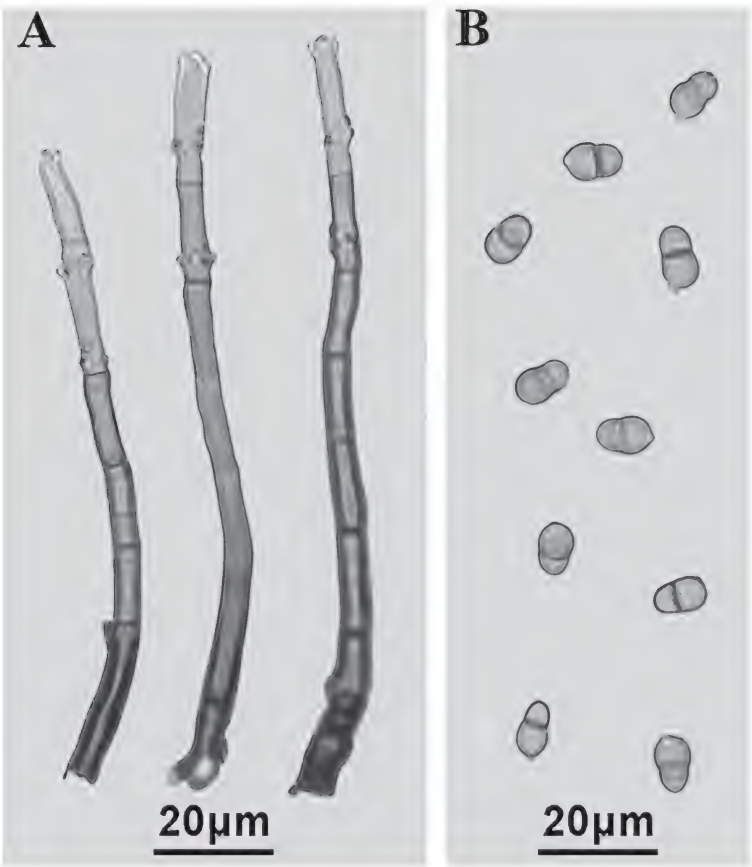

Fig. 2. *Cordana lithuanica*.
A. Conidiophores and conidiogenous cells. B. Conidia.

Cordana lithuanica Markovsk., Mycotaxon 87: 181, 2003. Fig. 2

Colonies on natural substratum brown, effuse. Mycelium mostly immersed and comprising branched, septate, subhyaline to pale brown, smooth hyphae.

Conidiophores distinct, single, erect, cylindrical, straight to flexuous, unbranched, extending apically 1–3 times, 80–210 µm long, 3.5–6 µm wide near the base, 3–5 µm wide at the apex, with terminal and intercalary swellings, septate, smooth, thick-walled, brown to dark brown, paler toward the apex. Conidiogenous cells polyblastic, integrated, sympodial, terminal and intercalary, brown, thick-walled, smooth, denticulate; denticles cylindrical, flat-topped. Conidia solitary, acropleurogenous, simple, obpyriform, 8.5–11 × 5–6.7 µm, medianly 1-septate, constricted at the septum, smooth, thick-walled, brown, rounded at the apex, with a protuberant hilum at the base, basal cell wider than apical cell.

Specimen examined: **CHINA**, **Hainan Province**: Bawangling National Natural Reserve, on dead branches of *Helicia pyrrhobotrya* Kurz (*Proteaceae*), 26 Nov. 2010, L.G. Ma (HSAUP H1874, HMAS 243413).

The Chinese specimen is similar to the original Lithuanian specimens (Markovskaja 2003), except that the Lithuanian material has much larger conidia (13–17.5 × 8–10 µm) and wider conidiophores (10–12 µm). This is the first record of *C. lithuanica* from China.

Sporidesmiopsis dennisii (J.L. Crane & Dumont) Bhat, W.B. Kendrick & Nag Raj, Mycotaxon 49: 71, 1993. Fig. 3

≡ *Brachysporiella dennisii* J.L. Crane & Dumont, Can. J. Bot. 56: 2613, 1978.

Colonies effuse, brown. Mycelium immersed and superficial, of branched, septate, brown, smooth hyphae. Conidiophores erect, distinct, single, straight or flexuous, septate, dark brown, smooth, thick-walled, with several branches near the apex, 250–620 × 13–18 µm. Branches short, dark brown, smooth, thick-walled, septate. Conidiogenous cells terminal and integrated on the branches, cylindrical, monoblastic, percurrent, dark brown, smooth, thick-walled. Conidia obclavate, straight or curved, dark brown becoming brown to subhyaline at the apex, 10–17-septate, smooth, thick-walled, truncate at base, sometimes rostrate, 78–122 × 12–18 µm.

Specimen examined: **CHINA**, **Yunnan Province**: Forbidden Forest of Banna, on dead branches of *Pistacia chinensis* Bunge (*Anacardiaceae*), 31 Oct. 2011, L.G. Ma (HSAUP H2114, HMAS 243415).

The morphological characters of our specimen fit well with those of the type material (Crane & Dumont 1978, as *Brachysporiella dennisii*). This is a first record of *S. dennisii* from China.

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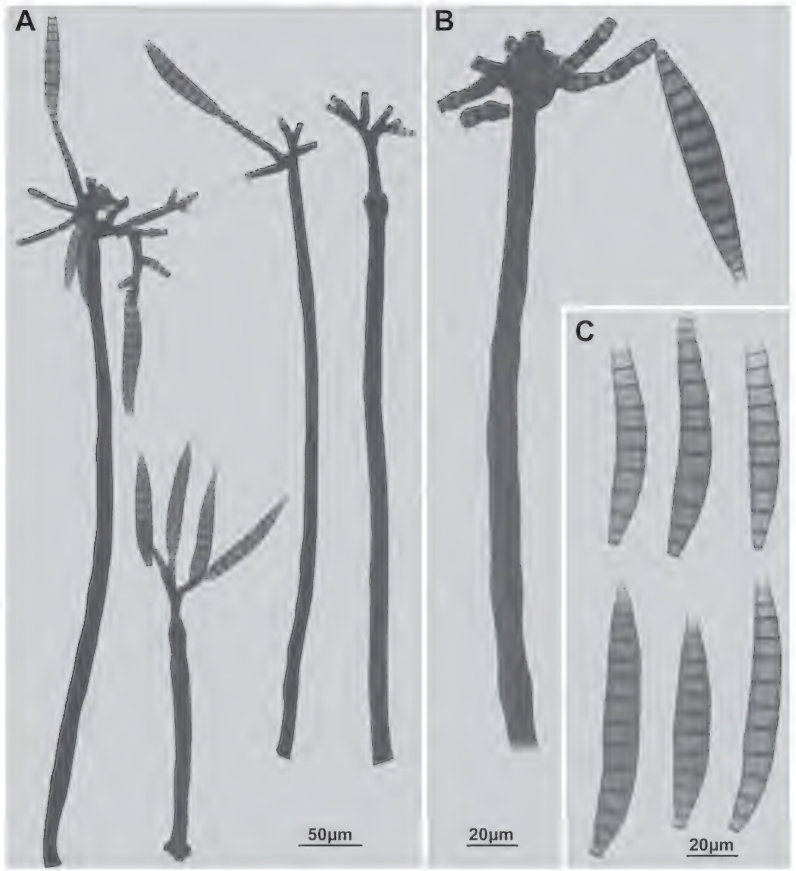

Fig. 3. *Sporidesmiopsis dennisii*.
A, B. Branched conidiophores, conidiogenous cells, and conidia. C. Conidia.

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Three new species of *Pleurophragmium* from Yunnan, China

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Abstract — Three new species are described and illustrated: *Pleurophragmium ellipsoideum* from dead branches of *Bauhinia acuminata*, *P. yunnanense* from dead branches of *Machilus salicina*, and *P. clavatum* from dead branches of *Beilschmiedia percoriacea*. All three species were collected from tropical forests in Yunnan Province, China.

Key words — anamorphic fungi, taxonomy

Introduction

Costantin (1888) established *Pleurophragmium* for a single species, *P. bicolor* Costantin. The genus is characterized by well defined single unbranched conidiophores with sympodial, terminal and intercalary, integrated, polyblastic, denticulate conidiogenous cells with pointed denticles and solitary apical and lateral conidia with pointed bases (Hughes 1958; Ellis 1971, 1976). These characters separate *Pleurophragmium* from similar genera — *Cordana* Preuss, *Cacumisporium* Preuss, *Spiropes* Cif., *Pseudospiropes* M.B. Ellis, *Minimelanolocus* R.F. Castañeda & Heredia, and *Dactylaria* Sacc. More than 20 species have been accepted in *Pleurophragmium*.

Several mycological papers dealing with many new species from China have been published recently (Zhang et al. 2009a,b, 2011, 2012; Liang et al. 2010, 2011; Dai 2011, 2012; Ma et al. 2011a,b, 2012). We collected three undescribed species of *Pleurophragmium* in our study on conidial fungi on dead wood from tropical forests in Yunnan Province, China. The specimens are deposited in HSAUP (Herbarium of the Department of Plant Pathology, Shandong Agricultural University) and HMAS (Mycological Herbarium, Institute of Microbiology, Chinese Academy of Sciences).

Taxonomy

Pleurophragmium ellipsoideum L.G. Ma & X.G. Zhang, **sp. nov.** FIG. 1

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Differs from *Pleurophragmium miniumbonatum* by its shorter and wider pale brown conidia with rounded apices, from *P. acutum* by its larger pale brown conidia with more septa, and from *P. obcampanuloides* by its wider conidia with more septa.

TYPE: China, Yunnan Province: the Forbidden Forest of Banna, on dead branches of *Bauhinia acuminata* L. (*Caesalpiniaceae*), 17 Oct. 2008, L.G. Ma (**holotype** HSAUP H0042; **isotype** HMAS 243411).

ETYMOLOGY: in reference to the ellipsoid conidial shape.

FIG. 1. *Pleurophragmium ellipsoideum* (holotype, HSAUP H0042).
a. Conidiophores and conidia. b. Conidiogenous cells with pointed denticles. c, d. Conidia.

Colonies on natural substratum effuse, brown. Mycelium partly immersed and partly superficial, composed of septate, branched, smooth, subhyaline to pale brown hyphae. Conidiophores well defined, single, unbranched, erect, straight or slightly flexuous, cylindrical, brown at the base, subhyaline to pale brown towards the apex, smooth, septate, thick-walled, 150–260 µm long, 2.5–3.5 µm wide at the apex, 3.5–6 µm wide at the base. Conidiogenous cells polyblastic, terminal and intercalary, integrated, sympodial, cylindrical, denticulate, smooth, thick-walled, subhyaline to pale brown, with numerous sharply pointed denticles towards the apex. Conidia solitary, apical and lateral, ellipsoid to obovoid, thick-walled, rounded at the apex, tapered to a point at the base, pale brown, smooth, 3-septate, 10–17 × 6.0–8.5 µm.

Notes: *Pleurophragmium ellipsoideum* is similar to *P. miniumbonatum* (R.F. Castañeda et al.) R.F. Castañeda, *P. acutum* (Grove) M.B. Ellis, and *P. obcampanuloides* Matsush. in conidial shape. However, *P. miniumbonatum* can be easily distinguished from *P. ellipsoideum* by its longer and narrower versicolored conidia with umbonate apices (16–19 × 6–7 µm; Heredia-Abarca et al. 2007). *Pleurophragmium acutum* differs by its smaller hyaline 0-septate conidia (6–12 × 2–3 µm; Ellis 1976), while the conidia of *P. obcampanuloides* are 2-septate and narrower (10–18 × 5–7 µm; Matsushima 1995).

Pleurophragmium yunnanense L.G. Ma & X.G. Zhang, **sp. nov.** Fig. 2

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Differs from *Pleurophragmium hippotrichoides* by its smooth conidia with more septa and from *P. ellipsoideum* by its broadly fusiform conidia with narrowed ends.

Type: China, Yunnan Province: the Forbidden Forest of Banna, on dead branches of *Machilus salicina* Hance (*Lauraceae*), 18 Oct. 2008, L.G. Ma (**holotype** HSAUP H0086; **isotype** HMAS 243412).

Etymology: in reference to the province where the taxon was found.

Colonies on natural substratum effuse, brown. Mycelium partly immersed and partly superficial, composed of septate, branched, smooth, subhyaline to pale brown hyphae. Conidiophores well defined, single, unbranched, erect, straight or slightly flexuous, cylindrical, brown at the base, subhyaline to pale brown towards the apex, smooth, septate, thick-walled, 185–270 µm long, 2.5–3.3 µm wide at the apex, 3.5–4.5 µm wide at the base. Conidiogenous cells polyblastic, terminal and intercalary, integrated, sympodial, cylindrical, denticulate, smooth, thick-walled, subhyaline to pale brown, with numerous sharply pointed denticles towards the apex. Conidia solitary, apical and lateral, broadly fusiform, thick-walled, narrowed at the ends, tapered to a point at the base, pale brown, smooth, (2)–3-septate, 10–15 × 6–7 µm.

Notes: *Pleurophragmium yunnanense* resembles *P. hippotrichoides* (Corda) M.B. Ellis in conidial shape, but *P. hippotrichoides* differs by its 0-septate

Fig. 2. *Pleurophragmium yunnanense* (holotype, HSAUP H0086).
a. Conidiophores and conidia. b. Conidiogenous cells with pointed denticles. c, d. Conidia.

verrucose conidia (Ellis 1976). *Pleurophragmium ellipsoideum* differs from *P. yunnanense* by its ellipsoid to obovoid conidia with rounded apices (see above).

Pleurophragmium clavatum L.G. Ma & X.G. Zhang, **sp. nov.** Fig. 3

MycoBank MB808633

Differs from *Pleurophragmium tritici* by its longer yellowish brown 0-septate conidia and from *P. acutum* by its larger yellowish brown verrucose conidia.

Type: China, Yunnan Province: the Forbidden Forest of Banna, on dead branches of *Beilschmiedia percoriacea* C.K. Allen (*Lauraceae*), 31 Oct. 2011, L.G. Ma (**holotype** HSAUP H2090; **isotype** HMAS 243416).

Etymology: in reference to the clavate conidial shape.

Colonies on natural substratum effuse, brown. Mycelium partly immersed and partly superficial, composed of septate, branched, smooth, subhyaline to pale brown hyphae. Conidiophores well defined, single, unbranched, erect, straight or slightly flexuous, cylindrical, brown at the base, subhyaline to pale brown

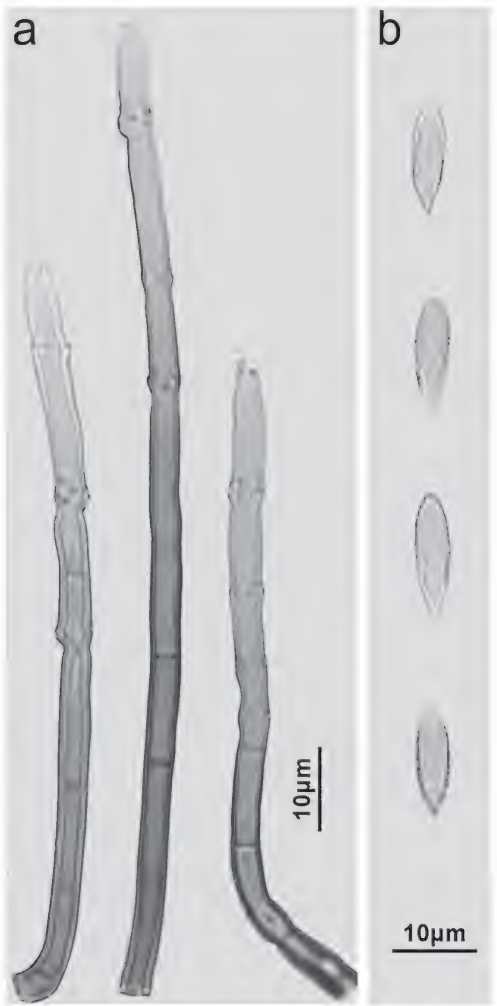

Fig. 3. *Pleurophragmium clavatum* (holotype, HSAUP H2090). a. Conidiophores and conidiogenous cells. b. Conidia.

towards the apex, smooth, septate, thick-walled, 75–160 µm long, 3.3–4 µm wide. Conidiogenous cells polyblastic, terminal and intercalary, integrated, sympodial, cylindrical, denticulate, smooth, thick-walled, subhyaline to pale brown, with numerous sharply pointed denticles towards the apex. Conidia solitary, apical and lateral, clavate to fusiform, thick-walled, narrowed at the ends, tapered to a point at the base, yellowish brown, verrucose, 0-septate, 9.5–16.5 × 3.5–4.5 µm.

Notes: *Pleurophragmium clavatum* is similar to *P. tritici* M.B. Ellis and *P. acutum* in conidial shape. However, *P. acutum* can be separated by its smaller hyaline smooth conidia (6–12 × 2–3 µm; Ellis 1976) and *P. tritici* by its shorter subhyaline or straw-coloured 0–1-septate conidia (6–11 × 3–4 µm; Ellis 1976).

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New taxa of the lichen genus *Pertusaria* from China

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Abstract — Three new species of *Pertusaria* from southwestern China are described, differentiated by morphology, anatomy, and chemistry. *Pertusaria wangii* is characterized by broad lecanorate verrucae, 8-spored asci, and production of norstictic acid. *Pertusaria hengduanensis* is characterized by 1-spored asci, 3-5 apothecia per verruca, and production of protocetraric acid. *Pertusaria lijiangensis* is characterized by 1-spored asci and the presence of hypothamnolic and cryptothamnolic acids.

Key words — *Ascomycota*, *Pertusariaceae*, taxonomy

Introduction

Pertusaria DC. is a highly diverse and globally distributed genus of microlichens. The apothecial structure, number of ascospores per ascus, spore structure, and chemistry are diagnostic in identifying species within the genus (Oshio 1968, Dibben 1980, Archer 1997, Schmitt & Lumbsch 2004). Although new records and new species have been reported in recent years (Zhao et al 2004, Ren et al 2009, Ren 2013), species diversity in *Pertusaria* from China is not yet determined with certainty. During a systematic survey of *Pertusaria* species in southwestern China, some interesting specimens were found that are proposed here as three new species.

Materials & methods

This report is based on specimens housed in SDNU (the Lichen Section of Botanical Herbarium, Shandong Normal University), KUN (Herbarium, Kunming Institute of Botany, CAS), and HMAS-L (the Lichen Section of Herbarium, Institute of Microbiology, CAS). A stereo-microscope (Olympus SZ 51) and a compound microscope (Olympus CX 21) were routinely used for the morphological and anatomical studies on all materials. Color reactions (spot tests) were made using standard methods (Orange et al. 2001). The chemical constituents were identified using thin layer chromatography (TLC) (Culberson 1972) and gradient-elution high performance liquid chromatography (HPLC) (Lumbsch 2002).

New species

Pertusaria wangii Q. Ren, **sp. nov.** PLATE 1A

MYCOBANK MB 807130

Differs from *Pertusaria submultipuncta* by its having 8 ascospores per ascus.

TYPE: China. Yunnan province, Lushui County, on the roadside between Fugong and Lushui Counties, 68 km north of Lushui county, alt. 2950 m, on dead twigs, 7 Jun. 1981, X.Y. Wang, X. Xiao & J.J. Su 2718 (**holotype**, HMAS-L).

ETYMOLOGY: the epithet "*wangii*" honours Professor Wang Li-Song (KUN), who has collected specimens and described the lichen diversity in southwestern China.

THALLUS gray, moderately thick, epiphloedal, without a definite margin; UPPER SURFACE initially tuberculate, later heavily rugose-plicate, generally matt, fissured. SOREDIA AND ISIDIA absent. FERTILE VERRUCAE lecanorate, concolorous with thallus, numerous, well dispersed or occasionally crowded and rarely fused, 1–1.5 mm in diam.. DISCS red, level or usually deeply sunken (in older verrucae), white-pruinose, the verrucal margins thick, initially entire and later ruptured forming a false secondary edge to the verrucae. APOTHECIA 1 per verruca, the fruit centre hyaline. EPITHECIUM red-brown, K–. ASCOSPORES 8 per ascus, ellipsoid, often uniseriate, occasionally irregular, 13–20 × 5–8 µm.

SPOT TESTS — K+ yellow to red, C–, KC–, P+ orange, UV–. Secondary metabolite: norstictic acid (TLC).

SUBSTRATE AND ECOLOGY — on dead twigs; at present known only from the type specimen.

COMMENTS — *Pertusaria wangii* is characterized by broad lecanorate verrucae, 8-spored asci, and the production of norstictic acid. Morphologically, the new species is similar to *P. submultipuncta* Nyl., which differs by having 1 ascospore per ascus (Oshio 1968) and to *P. ambigens* (Nyl.) Tuck., which differs by its South African distribution and production of connorstictic, protocetraric, and picrolichenic acids in addition to norstictic acid (Dibben 1980).

Pertusaria hengduanensis Q. Ren, **sp. nov.** PLATE 1B

MYCOBANK MB 807131

Differs from *Pertusaria lacericans* by its smaller ascospores and 3–5 apothecia per verruca.

TYPE: China. Yunnan province, Gongshan County, Qiqi Nature Reserve, alt. 1900 m, on tree trunk, 19 Jul. 1982, M. Zang Herb. No. 1452 (**holotype**, KUN).

ETYMOLOGY: referring to the Hengduan Mountains in southwestern China + the Latin suffix *ensis*, indicating place of origin.

THALLUS gray, moderately thick, epiphloedal, the margin ± entire; UPPER SURFACE smooth to tuberculate, or rugose-plicate (in older parts), generally matt, fissured. SOREDIA AND ISIDIA absent. FERTILE VERRUCAE concolorous

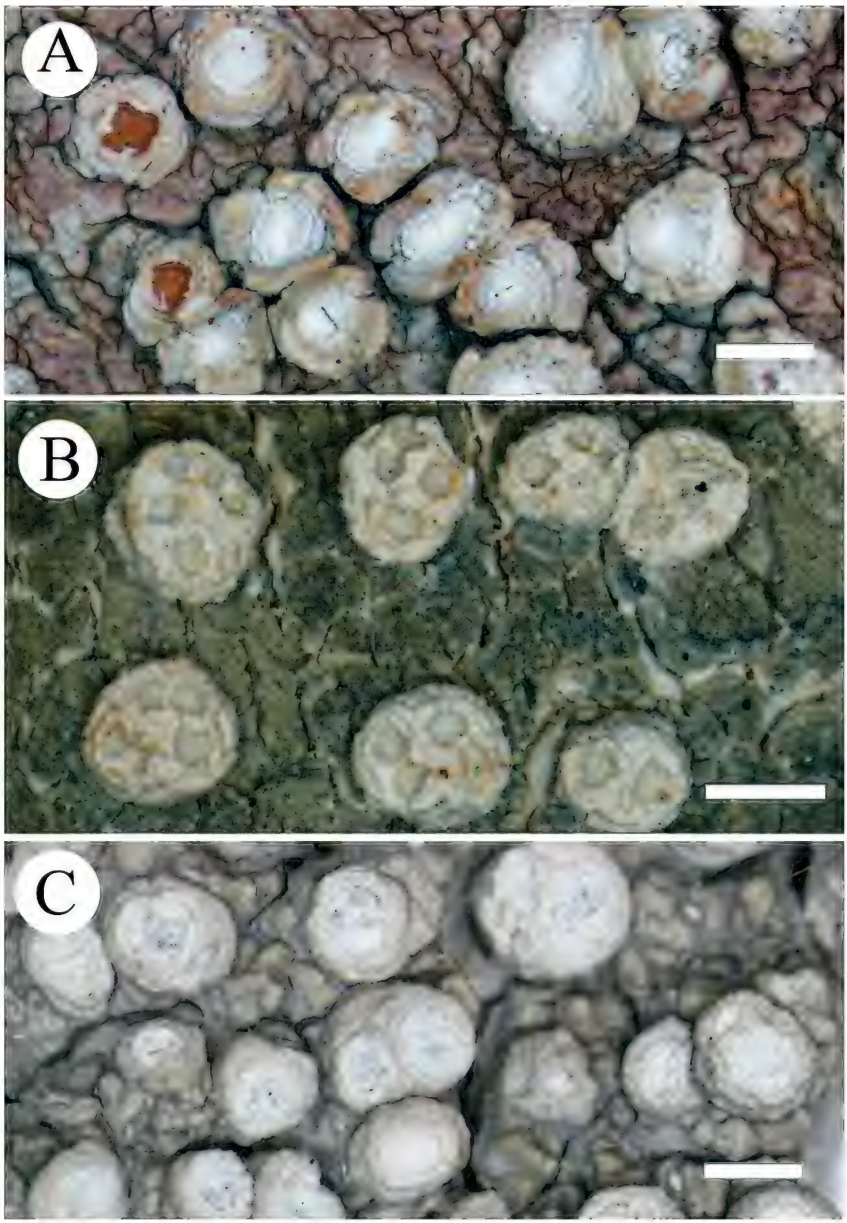

Plate 1. A, *Pertusaria wangii* (holotype, HMAS-L); B, *Pertusaria hengduanensis* (holotype, KUN); C, *Pertusaria lijiangensis* (holotype, SDNU). Scale bars = 1 mm.

with thallus, numerous, well dispersed or occasionally crowded, (0.8–)1–1.5 (–2) mm in diam.. Discs brown to black, 0.2–0.5 mm in diam., level, white-pruinose. Apothecia mostly 3–5 per verruca, lecanorate, the fruit centre hyaline. Epithecium red-brown, K–. Ascospores 1 per ascus, cylindric, 120–140 × 35–58 µm. Spore wall single, c. 3 µm thick.

Spot tests — K+ yellow, C–, KC+ pink, P+ orange-red, UV–. Secondary metabolite: protocetraric acid (TLC).

Substrate and ecology — on bark or dead twigs, and at present only known from Hengduan Mountains in southwestern China.

Additional specimen examined — **CHINA. Yunnan:** Lushui County, Pianma Town, on dead twigs, in broad-leaved evergreen forest, 29 May 1981, X.Y. Wang et al. 1835 (HMAS-L).

Comments — *Pertusaria hengduanensis* is characterized by 1-spored asci, 3–5 apothecia per verruca, and production of protocetraric acid. It is chemically similar to the Australian species *P. lacericans* A.W. Archer, which differs by its one apothecium per verruca and longer spores (170–180 µm; Archer 1991).

Pertusaria lijiangensis Q. Ren, **sp. nov.** Plate 1C

MycoBank MB 807133

Differs from *Pertusaria hypothamnolica* by its producing cryptothamnolic acid and lacking soredia.

Type: China. Yunnan province, Yulong County, Lijiang Alpine Botanical Garden, alt. 3590 m, on bark of *Rhododendron* sp., 16 Aug. 2011, Q. Ren 2011174 (**holotype**, SDNU).

Etymology: referring to Lijiang in Yunnan Province + the Latin suffix *ensis*, indicating place of origin.

Thallus grayish to gray, thin to thick, to 2 mm thick when on rock, epiphloedal, the margin ± entire and seldom zoned (but generally lighter colored than thallus); upper surface smooth to tuberculate, generally matt or only the margin shiny, continuous to slightly fissured, but rarely areolate. Soredia and isidia absent. Fertile verrucae concolorous with thallus, lecanorate, numerous, well dispersed to crowded, occasionally fused, (0.5–) 1–1.5(–2) mm in diam.. Discs pink to black, 0.5–1.0 mm in diam., level, slightly white-pruinose. Apothecia mostly 1 per verruca, at times 2–3 per verruca, the fruit centre hyaline. Epithecium red-brown, K–. Ascospores 1 per ascus, cylindric, 130–230 × 45–85 µm. Spore wall single, 3–9 µm thick.

Spot tests — K+ yellow becoming deeply purple, C+ pink, KC+ red, P+ yellow, UV–. Secondary metabolites: hypothamnolic acid (major), cryptothamnolic acid (major), decarboxyhypothamnolic acid (trace) (HPLC).

Substrate and ecology — on various kinds of barks or dead branches, especially on *Rhododendron* spp., *Quercus* spp., and *Pinus* spp. etc; rarely on rock.

Additional specimens examined — **CHINA. Yunnan Province**: Lijiang City, Lijiang Alpine Botanical Garden, alt. 3210 m, on *Rhododendron* sp., 16 Aug. 2011, Q. Ren 2011380 (SDNU); on *Quercus pannosa*, 16 Aug. 2011, Q. Ren 2011374 (SDNU); alt. 3380 m, on *Quercus pannosa*, 16 Aug. 2011, Q. Ren 2011218 (SDNU); alt. 3590 m, on bark, 16 Aug. 2011, Q. Ren 2011169 (SDNU); on *Rhododendron* sp., 16 Aug. 2011, Q. Ren 2011200, 2011454 (SDNU); Yulong Snow Mountain, alt. 3300 m, on bark, 14 Aug. 1982, J.N. Wu & A.T. Liu 82-195 (HMAS-L); alt. 3100 m, on trunk of rotten wood, 3 Aug. 1981, X.Y. Wang et al. 5015 (HMAS-L); Da li City, Mountain Cangshan, alt. 3450 m, on bark of *Pinus armandii*, 14 Aug. 2011, Q. Ren 2011444 (SDNU); Jianchuan County, Shibaoshan, alt. 2640 m, on bark of *Quercus acutissima*, 17 Aug. 2011, Q. Ren 2011287 (SDNU). **Guizhou Province**: Kaili City, Leishan County, Mountain Leigong, 26°23.029′N 108°12.445′E, alt. 892 m, on bark, 2 Apr. 2011, Z.T. Zhao 20102785 (SDNU); alt. 1800 m, on bark, 2 Apr. 2011, Y. L. Cheng 20112031, 20112155 (SDNU). **Xizang**: Linzhi County, Lulang Town, alt. 3500 m, on bark, 12 Jul. 2011, Y.L. Cheng 20118137 (SDNU). **Zhejiang Province**: Hangzhou City, Mount Tianmu, alt. 1500 m, on rock, 19 Oct. 2010, L. Lü 20104517 (SDNU).

Comments — Incorrectly known to Chinese lichenologists previously as *P. leptospora* Nitschke (= *P. multipuncta* (Turner) Nyl.), *P. lijiangensis* is characterised by asci with 1 ascospore and hypothamnolic and cryptothamnolic acids as major substances. The species is chemically similar to the North American species, *P. hypothamnolica* Dibben, which differs by producing soredia (restricted to the verrucae) and by containing lichexanthone (Dibben 1980).

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Book reviews and notices

Else C. Vellinga, *Book Review Editor**

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Abstract — Books reviewed include Guide to the common fungi of the semiarid region of Brazil by Neves, Baseia, Drechsler-Santos, & Góes-Neto and Ascomycete fungi of North America by Beug, Bessette, & Bessette.

Ascomycete fungi of North America. A mushroom reference guide. By M.W. Beug, A.E. Bessette & A.R. Bessette. 2014. University of Texas Press, P.O. Box 7819, Austin, TX 78713-7819. <info@utpress.utexas.edu>. ISBN 978-0-292-75452-2. Pp 488, 800 color photos. Price $85.00 [$56.95 33% website discount price]

This is the first guidebook on ascomycetes for North America. Regional guidebooks often contain the most conspicuous and edible species, but here, an attempt is made to cover the larger species and touch on the smaller more inconspicuous taxa. Around 600 species are mentioned in the text, with part of these fully described and illustrated.

The book starts out with a short introduction to the *Ascomycetes* (excluding the lichenized taxa), illustrated with photos of microscopical structures.

The key, which follows, is special, as it combines written couplets with choices of fruitbody photos to get to species. The truffle species can be keyed out with a dichotomous key as well. The emphasis is on macroscopical and habitat-related characters.

The next 370 pages contain the species descriptions and photos, arranged by group, starting out with the artificial group of hypogeous species, followed by the classes (*Pezizomycetes, Sordariomycetes, Leotiomycetes, Eurotiomycetes, Neolectomycetes, Orbiliomycetes, Dothideomycetes*, and *Taphrinomycetes*)

* Books for consideration for coverage in this column should be mailed to the Book Review Editor at the address above. All unsigned entries are by the Book Review Editor.

to which the treated species belong. The *Geoglossaceae* (here still including *Microglossum*) are treated separately as well.

A glossary, list of references, photo credits, and indices fill the last 34 pages.

Each species gets one or two pages — one sizeable photo, usually taken in situ, without scale bar — plus a standard description and discussion. The microscopic features are not depicted, just described. The emphasis is on the larger showier species, with the *Pezizomycetes* represented by a relatively high number of species.

The quality of the photos is variable, from very beautiful to uninformative (*Lasiosphaeria spermoides* looks like a black blob without any detail).

The discussions give a huge amount of information from the literature and cover the new developments and discoveries made in the molecular age.

It is great that there is now a book on ascomycetes for North America, and I hope that it will open the eyes of many amateur mycologists to the world of ascos beyond the edible morels.

On the minus-side, this book does not make it possible to identify every ascomycete in North America — far from it.

The coverage of species with fruitbodies <0.5 cm is very limited (e.g., only two species of *Hymenoscyphus* are included), and only a few species are represented for many genera (the under-studied genus *Mollisia* is represented by *M. cinerea,* even though the genus is species rich). In many genera, species concepts are very much in flux, and unfortunately European names are still used for American species: for instance, *Verpa conica* and *Sarcosphaera coronaria* are used, despite the fact that the western North American species differ from the European ones under those names.

The book is available with 33% discount from the University of Texas Press web site, which makes it very affordable. Its weight and size do not make it a book to take out in the field.

In short — this book fills a gap, but it should be accompanied by much more in-depth treatments of the groups in question. I hope that there soon will be follow-up publications that will focus on the smaller, less conspicuous ascomycetes.

Guide to the common fungi of the semiarid region of Brazil. By M.A. Neves, I. Goulart Baseia, E.R. Drechsler-Santos & A. Góes-Neto (eds). 2013. TECC Editora, Rua João Pio Duarte Silva 602, Apto. 302 Bloco A, Florianópolis, Santa Catarina, Brazil. <info@tecceditora.com>. ISBN 978-85-65005-03-6, 132 pages, numerous photos and line drawings. Price $34.95

I am always thrilled to see the publication of mushroom field guides for regions where not a single illustrated book to identify fungi has been available.

This little book acquaints us with the fungi of the drier, inland regions of northeastern Brazil, and starts out with a nice introduction to the area, its landscapes and vegetation types, followed by an overview of what fungi are.

The next 100 pages are filled with keys to, and photos and descriptions (in English and in Portuguese) of, around 80 species, arranged by systematic and morphological groups. A small spore drawing is given for each species as well. The last 20 pages contain the glossary, references, photo credits, and short blurbs about the editors. A total of seventeen authors contributed to this book.

The Brazilian guide differs from others of its kind in that the gilled mushroom section is not the biggest of the book; equal space is devoted to the polypores and the various kinds of gasteromycetes. Photos of *Abrachium floriforme* and *Clathrus cristatus* provide the 'wow' factor.

Many photos look slightly faint, which may be a result of the production process.

I hope that this book will stimulate the investigation of the natural world within Brazil, and entice foreign and Brazilian mycologists to keep adding to the knowledge of fungi in Brazil, and especially to the dispersal of the knowledge of these organisms.

Book announcement

A polyphasic taxonomy of *Daldinia* (*Xylariaceae*). By M. Stadler, T. Læssøe, F. Fournier, D. DeCock, B. Schmieschek, H.-V. Tichy, D. Peršoh. 2014. Studies in Mycology no. 77. CBS-KNAW Fungal Biodiversity Centre, P.O. Box 85176, 3508 AD Utrecht, The Netherlands. <info@cbs.knaw.nl>. Pp. 143, illustr. Price 60 € (paper copy, download free)

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Regional annotated mycobiota new to the Mycotaxon website

Abstract — Mycotaxon is pleased to announce a new species distribution list to our 'web-list' page covering lichens, lichenicolous, and allied fungi in Siberia, Russia (by Davydov). This brings to 111 the number of free access mycobiotas now available on the Mycotaxon website: http://www.mycotaxon.com/resources/weblists.html

Europe

Russia

Evgeny A. Davydov. The first checklist of lichens, lichenicolous, and allied fungi of Altaisky krai (Siberia, Russia). 67 p.

Abstract — The first check-list of lichen-forming, lichenicolous and allied fungi of Altaisky krai is presented. Literature records as well as distribution within the region are given for every species. The known species diversity of Altaisky krai at the present time has been estimated as 545 species of lichens, 12 lichenicolous fungi and one saprotrophic lichen-related fungus. Based on a completeness index relating the number of macrolichen species and expected number of microlichen species, the predicted lichen diversity of Altaisky krai would be about 882-1084 species.

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bad taxonomy

can KILL